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# Geology of the Saunders Lake Area District of Algoma

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By
F. W. Chandler

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Map 2331(coloured)–Saunders Lake Area, District of Algoma.

Scale 1 inch to ½ mile (1:31,680)

# ABSTRACT

Early Precambrian granitic rocks underlie the northern half of the map-area and form a salient, 'the Haughton High', in the northeastern part of Haughton Township. The granitic rocks are dominantly massive, pink, and equigranular, but contain the following; small zones of porphyritic and banded gneissic varieties of granitic rock, and xenoliths of amphibolite.

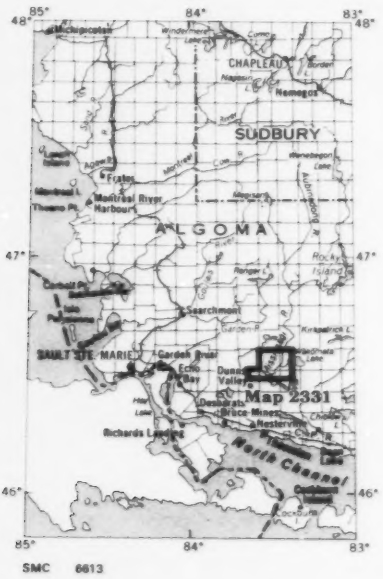



Figure 1–Key map showing location of the Saunders Lake area. Scale 1 inch to 50 miles (1:3, 168,000).

A body of mafic, partly amygdaloidal metavolcanics, which is ⅛ mile (0.2 km) wide and ½ mile (0.8 km) long, is exposed on the northwestern shore of Cooper Lake in Haughton Township. This body of 'greenstone' was shown on previous maps as part of the Gowganda Formation, and is similar to that found intercalated with sandstone at the base of the Huronian sequence west of the map-area.

Huronian sedimentary rocks are exposed in the southwestern and eastern parts of the map-area. Huronian rocks are exposed in southwestern Otter, northeastern Galbraith and northwestern Haughton Townships, and lie nonconformably on Early Precambrian granitic rocks. Matinenda feldspathic sandstone, minor granitic orthoconglomerate, and local rusty weathering quartz-pebble orthoconglomerate underlie a paraconglomerate with a grey sandy matrix that can be correlated with the Ramsay Lake Formation. In northeastern Galbraith and northwestern Haughton Townships at least three mappable units of paraconglomerate occur in feldspathic sandstone, and resemble the paraconglomerate that can be correlated with the Ramsay Lake Formation. The feldspathic sand-

stone may be correlated with the Mississagi Formation. Because the local structure is not known, the three paraconglomerate units are probably separate bodies, or one unit repeated by faulting.

The feldspathic sandstone was overlain by Gowganda orthoconglomerate and paraconglomerate that cap the hills around Cooper and Skookum Lakes. The Gowganda orthoconglomerate and paraconglomerate units were overlain by Gowganda interbedded argillite and micaceous sandstone.

In northwestern Gould and southwestern Casson Townships (formerly Township 188) the underlying Huronian rocks, were overlain by the Gowganda Formation which rests unconformably on Early Precambrian granitic rocks. In this region, a Gowganda paraconglomerate unit with minor intercalations of sandstone and orthoconglomerate was overlain by a unit of Gowganda laminated argillite. The Gowganda laminated argillite was overlain conformably by a feldspathic sandstone which is probably part of the Lorrain Formation.

Early Precambrian rocks were cut by dominantly northwest-striking mafic dikes. One mafic dike is a fresh porphyritic dike that is similar in appearance to the Matachewan Diabase. At least three Late Mafic dikes consist of olivine diabase. The Huronian Supergroup was cut by dikes consisting of quartz diabase. A quartz diabase sill with granophyric texture is exposed from the western boundary of Otter Township to the northwestern corner of Wakomata Lake.

Thin discontinuous deposits of sand, gravel, and till cover much of the map-area. Glacial striations indicate that a series of Pleistocene ice-sheets moved in a southerly and southwesterly direction. The Mississagi River valley and 2 square miles (5 $km^2$), on the western shore of Wakomata Lake were underlain by thick terrace deposits of fluvial sand and gravel.

Weakly developed foliation in Early Precambrian rocks strikes in a northwesterly direction. Huronian rocks dip 10 to 30 degrees in a southerly or southwesterly direction in the southwestern part of the map-area.

The base of the Gowganda Formation was probably upthrown along the southern shore of Skookum and Cooper Lakes by a probable fault that strikes east to northwest through the lakes.

The Huronian rocks east of the Mississagi River (east of the map-area) form an eastward-plunging syncline, the axial plane of which probably strikes east along the southern shore of Wakomata Lake. The Huronian rocks dip about 5 to 20 degrees to the north and south. The syncline is probably the western continuation of the Quirke Lake Syncline; if this is a correct interpretation, the Quirke Lake Syncline may be an elongate basin. The northern limit in the map-area of the Quirke Lake Group is hidden beneath the Gowganda Formation and may be part of an 'S' shaped fold that extends from the western part of Varley Township (formerly Township 176). The 'S' shaped fold can then be traced southward to Parkinson Township across a southeast-plunging part of the Chiblow Anticline, and then in a westerly direction to the northern part of Rose Township. Here, the shape of the fold is the same as that of the Elliot Lake 'Z' fold.

Pyritic quartz-pebble conglomerate exposed on the southern boundary of Otter Township could be uranium-bearing. Quartz veins, commonly found in diabase, contain copper sulphide minerals, and strike east-northwest. Additionally, at Burden Lake, a complex suite of sulphide minerals includes chalcopyrite, sphalerite, and cobaltite. Bismuth was recorded, native silver is also present. The Cheney Mine, in the northwestern part of Gould Township, was rehabilitated during 1966 and 1967.

# Geology

# of the

# Saunders Lake Area

## District of Algoma

By

F.W. Chandler[1]

## INTRODUCTION

### Access

Highway 129 extends north-south through the eastern part of the map-area, and connects Thessalon on Highway 17 with Chapleau. The eastern part of the map-area is about 30 miles (48 km) north of Thessalon. Highway 129 and several gravel roads give access to Chub, Cooper, Jobammageeshig, Pine Island, Saunders, and Wakomata Lakes; and also to the Mississagi River south of Snowshoe Creek. Other gravel roads, particularly that which continues from the northern part of Houghton Township into Otter Township, and which ends about 1 mile (1.6 km) south of the west end of Desayeaux Lake, can only be used by four-wheel-drive vehicles. Power boats can operate on most of the lakes.

The field party had a base camp at the Wakomata Camp, a tourist camp on the western shore of Wakomata Lake that is 1½ miles (2.4km) east of Highway 129 by gravel road. This gravel road leaves Highway 129 about ¼ mile (0.4 km) south of the bridge across Snowshoe Creek. Fly camps were made on Darragh and Burden Lakes for foot traverses in the northwestern and eastern parts of Otter Township. Float-equipped aircraft maintained by the Air Services Branch, Field Services Division, Ontario Ministry of Natural Resources were used to set up the fly camps.

[1]Geologist, 1971, Geological Branch, Ontario Department of Mines. Manuscript accepted for publication by the Chief Geologist, 21 February 1973.

## Field and Laboratory Work

Geological mapping of the area was done from May until August 1971 by a five-man field party. Two, two-man crews mapped separately each working day. Owing to thick bush-cover, pace-and-compass traverses were used to cover the area at intervals of ¼ mile (0.4 km) apart or less in areas of complex geology. Field data were in part recorded on transparent overlays attached to black-and-white air photographs which were at a scale of 1 inch to 1,320 feet (1:15,840). The photographs were supplied by the Air Photo Library, Administrative Services, Ontario Ministry of Natural Resources. The data were transferred from the air photos by means of a sketch master to base maps of the same scale prepared by the Cartography Section, Ontario Division of Lands, Ontario Ministry of Natural Resources.

The writer, S.J. Masson, M. Raudsepp and D.F. Faust did the field mapping.

The Huronian stratigraphic nomenclature, given by Robertson, Card, and Frarey (1968), and Robertson, Frarey, and Card (1969), is used in this report. Granitic rocks were classified in this report according to the method of Ayres (1972). The sedimentary rock classification used in this report is similar to that used by the writer (Chandler 1973). Quantitative estimates of minerals were made from thin sections using methods given in Terry and Chilingar (1955). Particle sphericity and roundness standards used in this report were those given by Rittenhouse (1943) and Powers (1953) that were modified by Folk (1955). The locations of the samples from which thin sections were taken are shown in Figure 5 in this report.

## Previous Geological Work

Parts of the map-area were mapped by Collins (1925), Emmons (1927), and Frarey (1959). The broad geological features of the map-area are shown on Ontario Division of Mines Compilation Map 2108, Sault Ste. Marie-Elliot Lake Sheet (Giblin and Leahy 1967, also see Robertson *et al.* 1971). The surficial geology is shown on Map S465 Surficial Geology, Algoma, Sudbury, Timiskaming and Nipissing Districts (Boissonneau 1965). Ontario Division of Mines-Geological Survey of Canada Aeromagnetic Maps 2213G, and 2227G show aeromagnetic features in the area. Ontario Division of Mines Aeromagnetic and Radioactive Maps of Galbraith Township (Map 77) and Gould Township (Map 78) were published at a scale of 1 inch to 1,320 feet (1:15,840). A record of exploration work and mining activity carried out in the map-area is kept in the Regional Geologist's Files, Ontario Ministry of Natural Resources, Sault Ste. Marie, and in the Assessment Files Research Office, Ontario Division of Mines, Toronto.

## Mineral Exploration

The map-area was prospected for copper since the early twentieth century. Exploration activity involved quartz veins that are probably associated with diabase intrusions.

A 3,300-foot (1000 m) long quartz vein system in a Nipissing Diabase sill strikes N35°W at the eastern end of Burden Lake in eastern Otter Township. This vein system received attention after 1910 (Burrows 1910, p.196), and contains chalcopyrite, chalcocite, and cobaltite; bismuth was recorded. An analysis of a bismuth-bearing sample showed 59.5 percent bismuth, 0.03 ounce of gold per ton, and 15.9 ounces of silver per ton (Burrows 1910, p.196). A 3.7 ton bulk assay gave 14.7 percent cobalt, 9.2 percent nickel, and 9 ounces of silver per ton (see Sergiades 1968, p.20, also Regional Geologist's Files, Ontario Ministry of Natural Resources, Sault Ste. Marie). The Cheney Mine, located in north-central Gould Township, is owned by Resource Exploration and Development Company Limited. Reserves in the Cheney Mine (now inactive) were estimated at 39,405 tons averaging 3.97 percent copper, and were contained in two shoots (see Regional Geologist's Files, Ontario Ministry of Natural Resources, Sault Ste. Marie).

More recent exploration for copper was done by diamond drilling. In 1956, Fano Mining and Exploration Incorporated drilled six diamond-drill holes totalling 1,003 feet (305.7 m) to test a chalcopyrite-bearing shear zone in Early Precambrian granitic rocks in southwestern Otter Township. The best recorded analyses were 1.71 percent copper over a width of two feet (0.6 m), and 3.51 percent copper over a width of 5 feet (1.5 m), (Shklanka 1969, p.47). In 1966 to 1967, G. Poirier diamond drilled 80 feet (24 m) in the chalcopyrite-bearing quartz vein located in the property owned by the Gould Copper Mines Limited in northwest Gould Township (Shklanka 1969, p.28), (also see files in Assessment Files Research Office, Ontario Division of Mines, Toronto). Plans (Elliot Lake Standard 1969) included the future extension of the adit for one mile (1.6 km). During the 1971 field season a drift was being driven along the vein by Gould Copper Mines Limited. In the summer of 1971, four diamond-drill holes with a total footage of about 1,220 feet (370 m) were drilled on the Reuben McKee Occurrence in east Otter Township into a chalcopyrite-bearing quartz vein associated with Nipissing Diabase in Early Precambrian granitic rocks (Assessment Files Research Office, Ontario Division of Mines, Toronto).

Ground geophysical surveys were carried out as follows: in 1966, on the north shore of Jobammageeshig Lake by the Mississagi Mining Company Limited; on the west shore of Wakomata Lake by Jubilant Creek Mines Limited; and in 1968 on the Reuben McKee property by Rio Tinto Canadian Exploration Limited (Assessment Files Research Office, Ontario Division of Mines, Toronto). The results of these surveys indicated that no further investigations were warranted at the time these reports were written. Since 1968, minor staking and development work have been carried out on copper prospects in the area by R.J. Jowsey Mining Company Limited (now Open End Mines Limited) and others (Assessment Files Research Office, Ontario Division of Mines, Toronto).

Because of the discovery of the Blind River uranium deposits, exploration for uranium has been carried out on the Huronian rocks in the southwestern part of the map-area. So far no uranium mineralization has been recorded.

In 1966, Kerr Addison Mines Limited diamond drilled 529 feet (161.2 m) of rock in four holes to test Matinenda quartz pebble conglomerate which is exposed on the south boundary of Otter Township (Assessment Files Research Office, Ontario Division of Mines, Toronto). In 1968, Imperial Oil Enterprises Limited diamond drilled two holes; the first at the southwestern end of Skookum Lake in

Galbraith Township, penetrated through Huronian sedimentary rocks into Early Precambrian granitic rocks at a vertical depth of 2,443 feet (744.6 m); the second, located on the north shore of Cooper Lake in Haughton Township, passed through 1,100 feet (330 m) of basalt and 1,450 feet (440 m) of Huronian sedimentary rocks before ending in Early Precambrian granitic rocks (Assessment Files Research Office, Ontario Division of Mines, Toronto).

Aerial geophysical surveys, which attempted to locate radioactive anomalies were flown in 1968 for Subeo Limited and for W.D. Sutherland and Associates in the map-area and adjacent areas (Assessment Files Research Office, Ontario Division of Mines, Toronto).

### Physiography

Elevations vary from about 1,500 feet (460 m) above mean sea level on the Early Precambrian granitic rocks in the north, to 1,200 to 1,300 feet (360 to 400 m) above mean sea level on the Huronian sedimentary rocks in the south of the map-area. The granitic rocks in particular are dissected by steep-sided negative lineaments giving local relief up to 200 feet (60 m). Maximum relief in the area is about 500 feet (150 m).

The area is thickly wooded with second-growth maple, birch, and poplar, except for northeastern Galbraith Township where some farming is done. Swampy areas are rare; spruce and balsam are prominent in them.

Lakes in the western part of the map-area drain into Wood Creek in Morin Township. The rest of the map-area is drained by the Mississagi River. These two drainage courses flow into Lake Huron.

### Acknowledgments

The author expresses gratitude to S.J. Masson, M. Raudsepp and D.F. Faust who mapped most of the Early Precambrian rocks, and to R. Guiton and B. Hoffman who were Junior Assistants.

## GENERAL GEOLOGY

The rocks exposed in the map-area fall into four main groups (Table 1):
(a) Cenozoic sediments.
(b) Post-Huronian mafic dikes and sills.
(c) Huronian sedimentary rocks and associated mafic volcanic rocks.
(d) Early Precambrian granitic rocks and mafic dike-like bodies.

The Early Precambrian rocks underlie much of the map-area and are well-exposed in the Mississagi River valley, northern Haughton Township. These rocks consist mainly of pink, massive to foliated granitic rocks, porphyritic grani-

tic rocks, and banded grey gneiss. Gneiss is prominent north of Wakomata Lake and east of Highway 129. Associated mafic intrusive dike-like rocks vary from strongly metamorphosed and sheared types to fresh porphyritic types, the latter probably are post-Kenoran and pre-Huronian in age.

Huronian sedimentary rocks are exposed in two areas in the southern half of the area about the Mississagi River. Huronian rocks east of the Mississagi River consist of part of the Cobalt Group and lie nonconformably on the Early Precambrian rocks. The Gowganda Formation consists of a paraconglomerate unit succeeded by an argillite unit, the top of which exhibits slump structures. The succeeding feldspathic sandstone may represent the lowest part of the Lorrain Formation, and forms extensive outcrops on the southern and eastern shore of Wakomata Lake.

The Huronian rocks are folded into an eastward-plunging syncline. South- to southwest-dipping Huronian sedimentary rocks west of the Mississagi River consist of a sequence of feldspathic arenite with interbedded siliceous paraconglomerate overlain by the Gowganda Formation. The lowest beds of feldspathic arenite are separated from the Early Precambrian rocks by an intervening regolith, and are correlated by the writer with the Matinenda Formation in this report. The siliceous paraconglomerate is mineralogically and lithologically similar to the Ramsay Lake Formation. The lowest paraconglomerate unit is the most widespread, and has been tentatively correlated by the writer with the Ramsay Lake Formation (Chandler 1970a, b), and overlies the Matinenda Formation in the map-area. A siltstone unit several feet (2m) thick overlying this paraconglomerate may represent the Pecors Formation. The succeeding siltstone unit is overlain by feldspathic arenite and interlayered siliceous paraconglomerate which are assigned to the Mississagi Formation by the writer.

Diamond drilling in Galbraith Township and more detailed mapping of the Huronian siliceous paraconglomerates would help to establish the stratigraphic positions of these paraconglomerates.

Extensive quartz diabase dikes and sills and a few olivine diabase dikes cut the Huronian rocks, and were traced on the ground for only short distances.

The Precambrian rocks are mantled by a thin discontinuous cover of Pleistocene sandy till. The last ice advance came from the north-northeast. Well-developed river terraces are formed of gravel in the Mississagi River valley west of Wakomata Lake, and are formed of sand in Haughton Township southeast of Cooper Lake.

## Precambrian

### EARLY PRECAMBRIAN (ARCHEAN)

Early Precambrian rocks underlie most of the northern half of the map-area and the Mississagi River valley in Haughton Township. They consist of mainly granitic rocks (1a, b, c) cut by numerous mafic dike-like bodies (2a, b, c), many of which have a northwesterly trend. Apart from porphyritic Matachewan-type dikes (2c) the mafic dikes appear to postdate Kenoran metamorphic events. The

**TABLE 1** | TABLE OF LITHOLOGIC UNITS FOR THE SAUNDERS LAKE AREA

**PHANEROZOIC**

CENOZOIC

QUATERNARY

Sandy till, fluvial gravels and sands, swamp deposits

*UNCONFORMITY*

**PRECAMBRIAN**

MIDDLE TO LATE PRECAMBRIAN

MAFIC INTRUSIVE ROCKS

| | |
|---|---|
| 9 | Unsubdivided |
| 9a | Nipissing-type quartz diabase |
| 9b | Granophyric quartz diabase (Red Rock) |
| 9c | Quartz diabase of uncertain age[1] |
| 9d | Olivine diabase |

*INTRUSIVE CONTACT*

MIDDLE PRECAMBRIAN

HURONIAN SUPERGROUP

COBALT GROUP

Gowganda Formation

| | |
|---|---|
| 8 | Unsubdivided |
| 8a | Orthoconglomerate (granitic megaclasts) |
| 8b | Orthoconglomerate and paraconglomerate (granitic megaclasts) |
| 8c | Paraconglomerate (wacke to mudstone matrix, pink granitic megaclasts) |
| 8d | Feldspathic sandstone (arenite)[2] |
| 8e | Sandstone (wacke) |
| 8f | Siltstone |
| 8g | Argillite (laminated) |
| 8h | Argillite (with dropped megaclasts) |
| 8j | Argillite (with pseudonodules) |
| 8k | Argillite |

*UNCONFORMITY AND REGIONAL OVERLAP*

HOUGH LAKE GROUP[3]

Mississagi Formation

| | |
|---|---|
| 7 | Unsubdivided |
| 7a | Feldspathic sandstone (arenite) |
| 7b | Paraconglomerate with siliceous matrix and quartz, granitic, and angular volcanic fragments |
| 7c | Feldspathic sandstone with pebble beds of black chert, jasper and vein quartz |
| 7d | Grey ripple-marked laminated siltstone[4] |

Ramsay Lake Formation

| | |
|---|---|
| 6 | Paraconglomerate and orthoconglomerate (siliceous, with quartz, granitic and angular volcanic megaclasts) |

**Table 1—continued**

*UNCONFORMITY AND OVERLAP*

ELLIOT LAKE GROUP[3]

Matinenda Formation

| | |
|---|---|
| 5 | Unsubdivided |
| 5a | Orthoconglomerate (with granitic cobbles and boulders) |
| 5b | Orthoconglomerate (with quartz pebbles and pyritic matrix) |
| 5c | Feldspathic sandstone (with quartz pebbles) |
| 5d | Feldspathic sandstone |
| 5e | Sandstone and siltstone (dark grey, micaceous) |
| 5f | Sandstone and siltstone (pyritic) |

MAFIC VOLCANIC ROCKS[5]

| | |
|---|---|
| 4a | Basalt (massive, chloritic) |
| 4b | Basalt (massive, chloritic, amygdaloidal) |

*BURIED LANDSCAPE NONCONFORMITY*

REGOLITH

| | |
|---|---|
| 3 | Quartz-sericite rock |

EARLY PRECAMBRIAN (ARCHEAN)

MAFIC INTRUSIVE ROCKS[6]

| | |
|---|---|
| 2 | Unsubdivided |
| 2a | Aphanitic greenstone, chlorite schist |
| 2b | Amphibolite |
| 2c | Porphyritic Diabase |

*INTRUSIVE CONTACT*

FELSIC INTRUSIVE AND METAMORPHIC ROCKS

| | |
|---|---|
| 1a | Banded gneiss and migmatite |
| 1b | Porphyritic granitic rocks |
| 1c | Massive granitic rocks |

NOTES:

1 Found cutting only Early Precambrian rocks.
2 May be Lorrain Formation.
3 Correlation of Huronian rocks older than the Gowganda Formation in this map-area is tentative, and may be revised after regional study of the lower part of the Huronian succession.
4 May be Pecors Formation.
5 Probably synchronous with deposition of part of the Matinenda Formation.
6 Some of these rocks may be volcanic.

**Table 2** | **Modal Analyses of Early Precambrian granitic rocks (1c).**

See text for petrographic data. Modal analyses in percent.

| Sample Number | 22EC3 | 22HC1 | 22HM1 | 221C1 |
|---|---|---|---|---|
| Plagioclase | 70 | 44 | 50 | 60 |
| Potassic Feldspar | trace | 10 | 10 | 5 |
| Quartz | 25 | 30 | 30 | 20 |
| other | 5 | 16 | 10 | 15 |
| Rock name | Trondhjemite | Granodiorite | Granodiorite | Trondhjemite |

dike-like bodies are subdivided into map-units on Map 2331, back pocket.

The granitic rocks (1c) are composed almost entirely of quartz and feldspar with accessory amounts of biotite and chlorite. Freshly broken surfaces are pink to dark pink, and weathered surfaces are also pink. The grain size ranges from 2 to 3 mm; mineral grains are rarely 1 mm or 4 mm in size. In some localities where feldspars are as much as 6 mm in maximum dimensions a minor porphyritic granitic phase (1b) was observed. The rocks are generally massive, but a northwest-trending foliation was observed (see Map 2331, back pocket). Pegmatite and pink aplite veins were noted in some outcrops. A second rock-type (1a) occurs most prominently north of Wakomata Lake and east of Highway 129 in a well-exposed area. The rock (1a) is a banded white to grey-weathered grey gneiss and migmatite; layering is 2 inches (5 cm) or less in thickness. Grain size of the gneiss is similar to that of the pink porphyritic granitic rocks. Pegmatites and aplites are more numerous in rock type (1a) than in other granitic rocks.

The mineralogical composition of four thin sections from different outcrops of (1c) and their classification is given in Table 2 (see also Figure 5). Mineral composition was estimated by using the visual estimation method described by Terry and Chilingar (1955, p.12).

Sample 22EC3 is a trondhjemite with a hypidiomorphic-granular texture. Plagioclase is euhedral to subhedral and quartz is anhedral. Accessory minerals are chlorite with interstitial calcite, green biotite, potassic feldspar, muscovite, opaque minerals (mainly iron oxide and leucoxene) and sphene.

Sample 22HC1 is granodiorite with a hypidiomorphic-granular texture and contains less then 5 percent chlorite (containing iron oxide and leucoxene), muscovite, sphene and other opaque minerals.

Sample 22HM1 is a granodiorite with a hypidiomorphic-granular texture containing less than 5 percent allanite, chlorite with iron-oxide inclusions, epidote, microcline, muscovite and sphene.

Sample 22IC1 is a trondhjemite containing about 10 percent biotite and chlorite with iron-oxide inclusions, and less that 5 percent calcite.

Textural variations in rock types (1b) and (1c) indicate that they are more homogeneous and perhaps younger than rock type (1a). West of the map-area (see Chandler 1973) data imply that rock types (1b and (1c) have a higher potassium content than rock type (1a).

## MIDDLE PRECAMBRIAN (PROTEROZOIC)

### Huronian Supergroup

#### ELLIOT LAKE GROUP

Huronian clastic sedimentary rocks lie nonconformably on Early Precambrian granitic rocks and occur mainly in the southwestern and southeastern parts of the map-area. The Huronian rocks have been tentatively assigned to the Matinenda, Ramsay Lake, Mississagi, and Gowganda Formations. In the southeastern part of the map-area the Gowganda Formation nonconformably overlies Early Precambrian granitic rocks and is overlain by feldspathic sandstone (8d) that may belong to the Lorrain Formation (Figure 2).

##### Regolith

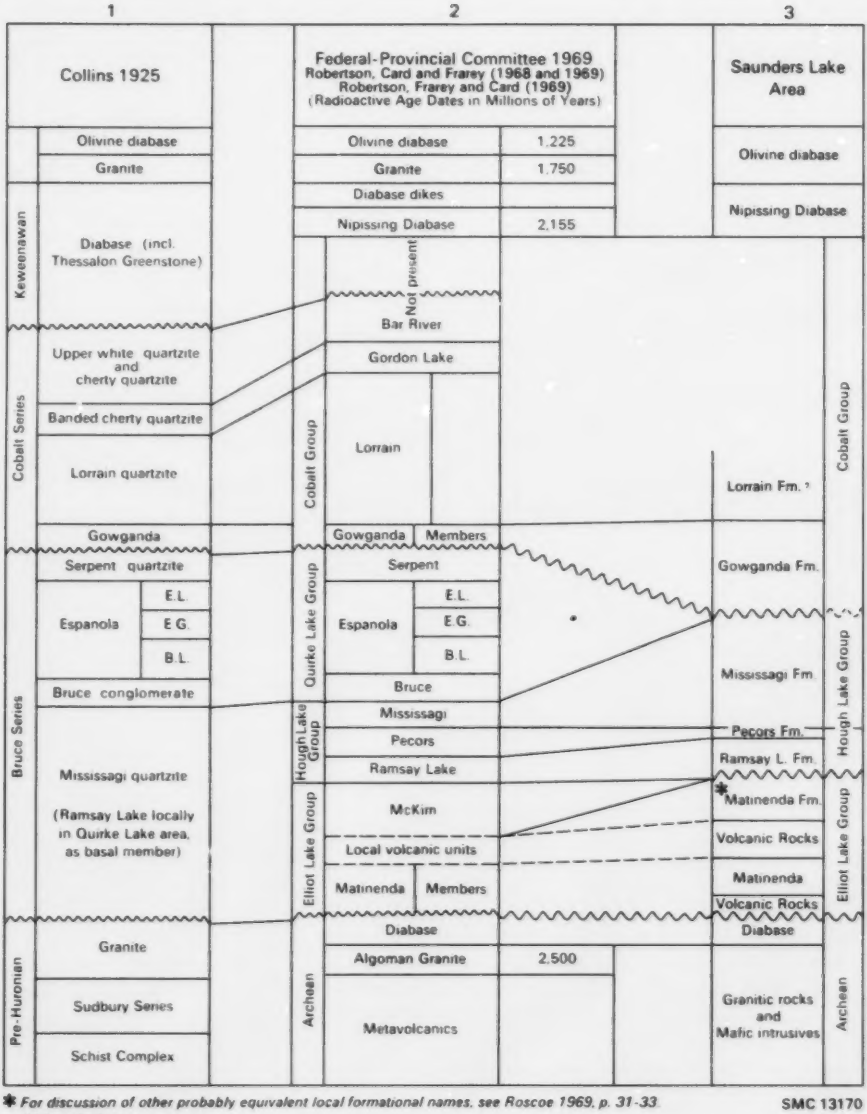
The regolith (3) is exposed in the southwestern part of the map-area at or near the boundary between the Early Precambrian granitic rocks and the overlying Matinenda Formation. The regolith is not exposed in the southeastern part of the area at the lower boundary of the Gowganda Formation. The exposures are about ⅓ mile (0.5 km) southeast of Desayeux Lake in Otter Township and the northeastern corner of lot 8, concession VI, Haughton Township.

The rock has the appearance of a granitic rock in which minerals other than quartz have been replaced by an aphanitic light green-grey material. A study of thin sections of the rock (see Chandler 1973, p. 11) showed that the rock consists of quartz grains set in a sericitic matrix that may be mica-illite (Roscoe 1969). The quartz grains retain the foliation of the original granite. The writer has concluded that part of the regolith is exhumed post-Archean (Early Precambrian) and pre-Huronian weathered material.

##### Mafic Volcanic Rocks

Middle Precambrian mafic volcanic rocks were found interlayered with Huronian sedimentary rocks in McMahon and Morin Townships (Chandler 1973). Similar volcanic rocks were found by the author at several places at the base of the Matinenda Formation in southwest Otter Township. A body of volcanic rock

## Saunders Lake Area




* *For discussion of other probably equivalent local formational names, see Roscoe 1969, p. 31-33.*

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***Abbreviations:***

*E. L.—Espanola limestone.*
*E. G.—Espanola greywacke.*
*B. L.—Bruce limestone.*

**Figure 2–Comparison chart of stratigraphic nomenclatures for Huronian Rocks used on the North Shore of Lake Huron with that used in the Saunders Lake Area.**

approximately ⅛ mile by ½ mile (0.2 km by 0.8 km) was found by the author between Cooper and Skookum Lakes in northwestern Haughton Township. The writer suggests that the last exposure be called the 'Cooper Lake Volcanic Rocks'. Because of sparse outcrop and probable structural dislocations the stratigraphic position of the 'Cooper Lake Volcanic Rocks' is uncertain. However, diamond-drill holes (see Figure 3) show that Middle Precambrian mafic volcanic rocks underlie the lowest Ramsay Lake-type paraconglomerate and thus are likely to be intercalated with the Matinenda Formation. The stratigraphic position of these volcanic rocks is important because they may be a source of the angular black volcanic (?) pebbles occurring in the Ramsay Lake-type paraconglomerate which is present in the southwestern part of the map-area. Nevertheless, the author (Chandler 1973, p.12) indicated a lower Huronian age for similar mafic volcanic rocks.

The mafic volcanic rock (4) at Cooper Lake is green, massive to sheared, and has aphanitic grains that are as much a 1 mm across. Chlorite-filled amygdules were noted in the volcanic rock on the north shore of Cooper Lake. Possible deformed pillows are present on the headland ¼ mile (0.4 km) west of two islands in the centre of Cooper Lake. The presence of granitic pebbles in an outcrop ¼ mile (0.4 km) west of this outcrop indicates that the volcanic rock could have passed over or through lower Huronian (probably Matinenda Formation) pebble gravel. Petrographic and chemical analyses of the 'Aberdeen Volcanics' in southwestern McMahon Township (Chandler 1973) suggest that the chemical composition of these volcanic rocks may be that of a tholeiitic basalt. One sample from Cooper Lake contains chlorite, quartz, epidote, and laths of iron oxide and has a grain size of 0.05 to 0.1 mm, and also contains vesicles filled with quartz and chlorite.

### Matinenda Formation

In southwestern Otter Township the Matinenda Formation is well exposed in the environs of Desayeux Lake, particularly so in the shoreline outcrop at the eastern end of this lake. At the eastern end of Desayeux Lake pink Early Precambrian granitic rocks are overlain by up to 40 feet (12 m) of boulder orthoconglomerate (5a) (Photo 1). The upper few feet (1-2 m) of the granitic rocks are pale greenish; this suggests that some weathering of the rocks has taken place. The material is probably a regolith. Cracks in an exposure that show the boundary surface contain light green, poorly sorted, fine-grained sandstone. Phenoclasts in the orthoconglomerate mainly consist of granitic rock and white quartz. The matrix of the orthoconglomerate is a pale green grit. The orthoconglomerate is also present on the eastern shore of a lake ½ mile (0.8 km) north of Saint Onge Lake in Otter Township and in exposures scattered in other locations in southwestern Otter Township.

At the eastern end of Desayeux Lake (Photo 1) the conglomerate is succeeded conformably by an erosional remnant, 3 feet (0.9 m) thick, consisting of flaggy grey siltstone to fine-grained sandstone which weathers pale green to grey (5e). To the southwest in Otter Township, the arenaceous Matinenda Formation is exposed where erosion has removed the overlying Ramsay Lake Formation

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Photo 1–Base of the Matinenda Formation at east end of Desayeux Lake, Otter Township. Massive pink granitic basal cobble to boulder orthoconglomerate underlies a pale green weathering, grey, silty, fine-grained flaggy sandstone. Strata dip to the right.

(6). Fine-grained grey sandstone (5e), seldom with disseminated pyrite (5f), is exposed at many localities near the base of the Matinenda Formation in the southwestern part of Otter Township. The orthoconglomerate is of local origin and may occupy depressions on the Early Precambrian erosion surface. In other localities, a grey immature arkosic grit occurs immediately above the regolith (3).

As the base of the Matinenda Formation is traced southwest across Desayeux Lake, the fine-grained grey sandstone changes to a pink, and pink weathering, mainly coarse-grained sandstone; subhedral feldspar clasts as much as 0.8 cm long are visible in some outcrops. Exposures of the rock may appear to be massive, bedded or crossbedded. Two samples of the coarse-grained feldspathic sandstone (5d), sample numbers 23DC2, 23DC4 are described below. White quartz pebbles are scattered in the coarse-grained pink sandstone (5c), particularly within a few feet of the boundary with the overlying Ramsay Lake Formation paraconglomerate (6). On the south shore of Desayeux Lake a few feet of Matinenda sandstone immediately underlying the Ramsay Lake Formation are coarse grained and white.

Pyritic quartz-pebble orthoconglomerate (5b) occurs in the north half of lot 8, concession VI, of Haughton Township. The occurrence in Haughton Township (Photo 2) is exposed at the top of a southeast-facing 150-foot (46 m) high cliff of grey medium-grained sandstone and grey feldspathic grit of the Mati-

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Photo 2–Pyritic quartz-pebble orthoconglomerate bed in the Matinenda Formation, lot 8, concession V, Haughton Township. View is of vertical face cutting across horizontal stratum. Dark stain in conglomerate matrix is oxidised pyrite.

nenda Formation. At the top of the cliff, beds of quartz-pebble orthoconglomerate, which are as much as 5 feet (1.5 m) thick, can be traced for 20 feet (6 m). The conglomerate is rusty or black; pyrite has partly altered to limonite and hematite. The conglomerate beds appear to dip northward at about 10 degrees. Beds of rusty weathering pyritic quartz-pebble orthoconglomerate (5b) as much as 3 feet (0.9 m) thick, with pebbles 0.8 inch (20 mm) long, are interbedded with pale green to pale pink arkosic grit ½ mile (0.8 km) northwest of the pyritic quartz- pebble orthoconglomerate outcrop in the north half of lot 8, concession VI, Haughton Township. Fresh samples from this outcrop were tested for radioactivity; no anomalies of note were found. The outcrop to the northwest in Otter Township was diamond drilled (see section on 'Economic Geology') with similar results.

Northwest of Desayeux Lake several outliers of Matinenda feldspathic sandstone are less than ¼ mile (0.4 km) long and are exposed on top of Early Precambrian granitic rocks. One contains quartz pebbles, and another is overlain by Ramsay Lake-type paraconglomerate.

Six thin sections were cut from the Matinenda Formation as follows: grey fine-grained sandstone (5e,f), sample numbers 23DC6, 23DC7; a succeeding pale feldspathic sandstone (5d) sample numbers 23DC2, 23DC4; and a matrix of quartz-pebble orthoconglomerate (5b) sample numbers 22EC8, 23EC8A. Sample number 23DC6 (5e) is an arkosic wacke [sandstone and siltstone on Map 2331,

back pocket] which varies in grain size from a coarse silt to a very fine sand. Detrital phyllosilicate minerals, elongate quartz, and feldspar grains are preferentially concentrated parallel to the bedding plane of the rock. The sample contains about 40 percent quartz; 20 percent potassic feldspar; 35 percent of an unresolvable matrix (<.03 mm) which is probably sericite-rich; about 2 percent each of detrital biotite and chlorite; and minor interstitial (?) detrital muscovite, oligoclase, sericite, leucoxene, and hematite. The shape of the quartz grains varies from a sphericity of 0.85 to an elongation of 10, and is angular to very angular.

Sample 23DC7 (5e), higher in the stratigraphic sequence than 23DC6, is a very fine grained arkose [sandstone and siltstone on Map 2331,back pocket] to subarkosic wacke with about 35 percent quartz, 25 percent potassic feldspar, and 30 percent unresolvable matrix including diagenetic carbonate. Accessory minerals include oligoclase, muscovite, about 2 percent biotite, 2 percent chlorite, and 2 percent leucoxene. The shape of quartz grains is similar to that of sample 23DC6.

Sample 23DC2 (5d) is a coarse-grained subarkose [feldspathic sandstone on Map 2331, back pocket] consisting of 75 percent quartz, 20 percent potassic feldspar, and minor plagioclase. Two percent interstitial sericite is associated with, and may be derived from feldspar grains. Quartz overgrowths prevent determinations of the original shape of the quartz grains. Feldspar grains are subangular having sphericities that range from 0.65 to 0.85.

Sample 23DC4 (5d) is a fine-grained subarkose [feldspathic sandstone on Map 2331, back pocket] consisting of 85 percent quartz, 15 percent potassic feldspar (mainly untwinned), and a trace of interstitial sericite. The quartz grains have sutured contacts with other minerals. Feldspar grains have sphericities which range from 0.65 to 0.85, and have angular to subangluar shapes.

Samples 22EC8 and 22EC8A (5b) and (5a) are quartz-pebble orthoconglomerates composed of 60 percent polycrystalline quartz pebbles set in 40 percent of coarse sand matrix that consists of quartz, sericite, and pyrite. The matrix quartz has a sphericity of 0.6 to 0.8, and has an angular to subangular shape. Pyrite grains, 0.1 to 0.5 mm in maximum dimension are disseminated in the rock, and vary in outline from being ragged, to rounded or euhedral in form. Thus, the shape of the pyrite grains underlines Roscoe's (1969) statement that pyrite in quartz-pebble orthoconglomerate (in the Elliot Lake area ores) has a mixed diagenetic-detrital origin.

## HOUGH LAKE GROUP

### Ramsay Lake Formation

Several exposures of similar siliceous paraconglomerate were found by the writer in the map-area. Some have tentatively been placed in the Ramsay Lake Formation. Other exposures of siliceous paraconglomerate are considered by the writer from evidence in the area and diamond drill-core data (see section on 'Stratigraphic Problems') to belong to the Mississagi Formation.

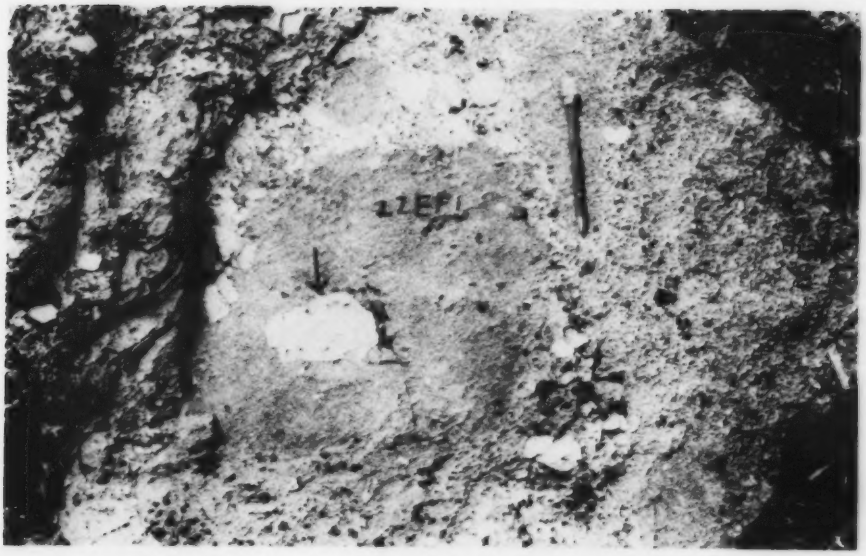

Photo 3–Clast of sericitic mudstone in quartz pebbly sandstone matrix in unusual siliceous paraconglomerate outlier (Ramsay Lake Formation (?)) that overlies Matinenda Formation. Location ¼ mile (0.4 km) north of south boundary of Otter Township and ⅓ mile (0.5 km) east of a gravel road. For details see text.

Outliers of paraconglomerate (6) are exposed between Sorenson and Saint Onge Lakes, and 1 to 2 miles (1.6 to 3 km) east of Saint Onge Lake in Otter Township; some of them overlap the Matinenda Formation and overlie the Early Precambrian basement. A similar unit of paraconglomerate was traced across the southern part of Morin Township (Chandler 1973). This unit interdigitates between several feldspathic sandstone units, is believed by the writer to continue across Saint Onge Lake, strikes east-southeast, and crosses the northern boundary of Haughton Township at the northwest corner of lot 9, concession VI. This conglomerate unit is believed to be the southwestern continuation of the outliers of paraconglomerate (6) and was correlated with the Ramsay Lake Formation by the writer (Chandler 1970b).

Another outlier of paraconglomerate was found to partly overlie the Matinenda Formation about ½ mile (0.8 km) northeast of the site where diamond drilling by Kerr Addison Mines Limited was undertaken on the southern boundary of Morin Township. This rock-type, not seen elsewhere in the map-area by the writer, consists of massive, poorly sorted, pale grey to green sericitic quartzite with white 'quartz eyes' and irregular strands of white quartz pebbles and cobbles. In some outcrops masses of sandstone or bent angular masses of sericitic green mudstone are included in a matrix of white quartz-pebble orthoconglomerate (Photo 3). The diffuse nature of the boundaries of the masses indicates that the disruption of a soft sediment formed this rock. The rock type resembles nor-

mal Ramsay Lake paraconglomerate (6) and Mississagi Formation (7b), although no angular mafic volcanic megaclasts were seen. Pyrite, characteristic of the matrix of quartz-pebble orthoconglomerate of the Matinenda Formation (5b), is also absent. It is possible that this rock type represents a mixture of quartz-pebble orthoconglomerate (5b), a regolith, and a sericitic quartzite of the Matinenda Formation. Nevertheless, the outlier forms a prominent hill similar to local outliers of the Ramsay Lake Formation. High-angle reverse faulting may have raised the south- to southwest-dipping Ramsay Lake Formation so that it outcrops between Skookum Lake in Galbraith Township, and Cooper Lake in Haughton Township.

Paraconglomerate (7b), which is exposed between Skookum and Cooper Lakes, and at a locality ½ mile (0.8 km) southwest of Skookum Lake probably occurs within the Mississagi Formation.

The paraconglomerates (6, 7b) are massive except where sheared, such as along the Skookum Lake-Cooper Lake Fault Zone. Megaclasts are composed of pebbles and cobbles of pink and white granitic rock, white quartz, and an angular mafic volcanic rock. Megaclasts are set in a quartz wacke matrix which is grey to pale grey, and weathers grey, pale grey, or pale green.

The matrix of the paraconglomerate (6) unit exposed on the western shore of Skookum Lake and along the southern shore of Cooper Lake consists of 50 percent angular to subangular quartz of coarse and fine sand size, with few coarser fragments, and minor amounts of microcline, perthite, chlorite-rich fragments, and granitic fragments. Also present are a few fragments of glass or chloritised intermediate to felsic tuff. A few quartz grains which show high roundness and sphericity are also present. The remaining 50 percent of each sample consists of unresolvable material finer than 0.01 mm which contains quartz, white mica, chlorite, and in one sample, patches of calcite.

### Pecors Formation(?)

A siliceous paraconglomerate traceable from south-central Morin Township (west of Otter Township) into the map-area has been assigned by the writer to the Ramsay Lake Formation (6). Laminated and rippled siltstone, which is 60 to 100 feet (20 to 30 m) thick, is exposed between this conglomerate and the overlying Mississagi Formation. This fine-grained clastic rock is probably an attenuated stratigraphic equivalent of the Pecors Formation. This possibility is discussed at length in the section on 'Stratigraphic Problems'. Similar siltstone exposed in Galbraith Township (see section on 'Mississagi Formation') probably should be correlated with the Mississagi Formation.

### Mississagi Formation

A feldspathic sandstone unit overlying the Ramsay Lake paraconglomerate (6) has been assigned by the writer to the Mississagi Formation. This unit is a subarkose (7a), light grey, pink or buff, and weathers buff, pink, or rusty. The

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Photo 4–A bedding-plane exposure of pebbly subarkose (7c), Mississagi Formation (northeastern corner of lot 6, concession VI, Galbraith Township). White quartz pebbles are more abundant than black chert pebbles, which in turn are more abundant than jasper pebbles.

subarkose is mainly medium grained, though some varieties vary from a fine sand to a grit that is 2 to 4 mm in grain size. Locally, argillite and ripple-marked laminated siltstone (7d) are associated with paraconglomerate (7b) which is intercalated in the feldspathic sandstone or arkose (7a). Examples of argillite and ripple-marked and laminated siltstone (7d) were found ¼ mile (0.4 km) south of the centre of Cooper Lake in Haughton Township, and in the north half of lot 5, concession V, Galbraith Township. Toward the top of the Mississagi Formation pebbly sandstone (7c) contains pebbles ½ to 1 inch (0.6 cm to 2.5 cm) in size; black chert and jasper pebbles may be scattered 1 to 2 feet (0.3 to 0.6 m) through the feldspathic sandstone part, or may be concentrated in diffuse layers 1 to 2 pebbles thick. A typical example of a bedding-plane exposure of the latter rock type from a locality ¼ mile (0.4 km) west of Skookum Lake is shown in Photo 4. The rock is a pink weathering grey to pink sandstone with quartz, black chert, and jasper.

Sedimentary structures in Mississagi sandstone (arenite) include trough crossbeds of undetermined type, and layering which is ½ inch (1 cm) to 2 inches (5 cm) thick. Elsewhere, layering was found to be characteristic of the Mississagi Formation and is caused by minor variations in mineralogy (Chandler 1969). Bedding is present in a few localities and is 2 to 3 feet (0.6 to 0.9 m) thick.

Five thin sections of the subarkose (7a) were examined by the writer. Two of them, 21BC2 and 21BC4, were used to determine the mineral composition of the

feldspathic sandstone occurring in the southern half of lots 3 and 4, concession VI, Galbraith Township. The feldspathic sandstone overlies a paraconglomerate placed by Frarey (1959) in the Bruce Formation.

Sample 21BC2 is a coarse-grained subarkose consisting of 80 percent rounded, equant (sphericity 0.85) quartz grains with long or convex boundaries, 15 percent potassic feldspar (orthoclase and microcline are in approximately equal proportions), and 5 percent sericite matrix. Sample 21BC3 is a medium-grained subarkose, but is otherwise similar to sample 21BC2. Sample 21BC4 is a medium-grained subarkose consisting of 70 percent angular to subangular, equant (sphericity 0.8) quartz grains, 20 percent potassic feldspar (orthoclase, microcline, and microperthite), 9 percent white mica matrix, and about 1 percent detrital biotite, chlorite, and white mica. Sample 22BC1 is a fine-grained subarkose consisting of 75 percent quartz (sphericity 0.75), 20 percent potassic feldspar (orthoclase and microcline are in approximately equal proportions), and less than 5 percent sericitic matrix. Sample 22BC2A, very similar to typical Mississagi sandstone (Chandler 1969), is a medium- to coarse-grained subarkose consisting of 85 percent subrounded quartz grains (sphericity of 0.83), 9 percent potassic feldspar and granitic fragments, and 5 percent white mica matrix.

The writer suggests that five separate bodies of paraconglomerate (7b) although similar to those in the Ramsay Lake Formation, should be placed in the Mississagi Formation. Four of them are located with reference to concession VI, Galbraith Township as follows: (a) ¼ mile (0.4 km) north of the north boundary of lot 4 [outside the map-area]; (b) north of the north boundary of lot 5 [outside the map-area]; (c) lots 5 to 7 [partly outside the map-area] and the south half of lot 3. The fifth body of paraconglomerate is in the north half of lot 8, concession VI, Haughton Township [shown on Map 2331 as 6]. The field appearance of the paraconglomerate is illustrated by Photo 5.

## COBALT GROUP

### Gowganda Formation

The Gowganda Formation is present in several parts of the map-area. In northeastern Galbraith and northwestern Haughton Townships the formation overlies the Mississagi Formation and consists of a massive paraconglomerate unit succeeded by a unit of argillite interbedded with micaceous and feldspathic sandstone. The units are named Members 8C and 8EK respectively by the writer in this report. The Gowganda Formation overlies the Early Precambrian granitic basement in the southeastern and eastern parts of Otter Township. In the southeastern part of the map-area the Gowganda Formation consists of a paraconglomerate, Member 8C, succeeded by the following: a laminated argillite member, Member 8G; an argillite member with sand slump balls (Kuenen 1948),Member 8J; and a feldspathic sandstone Member 8D which may belong to the Lorrain Formation. The Lorrain Formation forms a high plateau on the east side of Wakomata Lake in Jackson Township (Township 182) [east of the map-area].

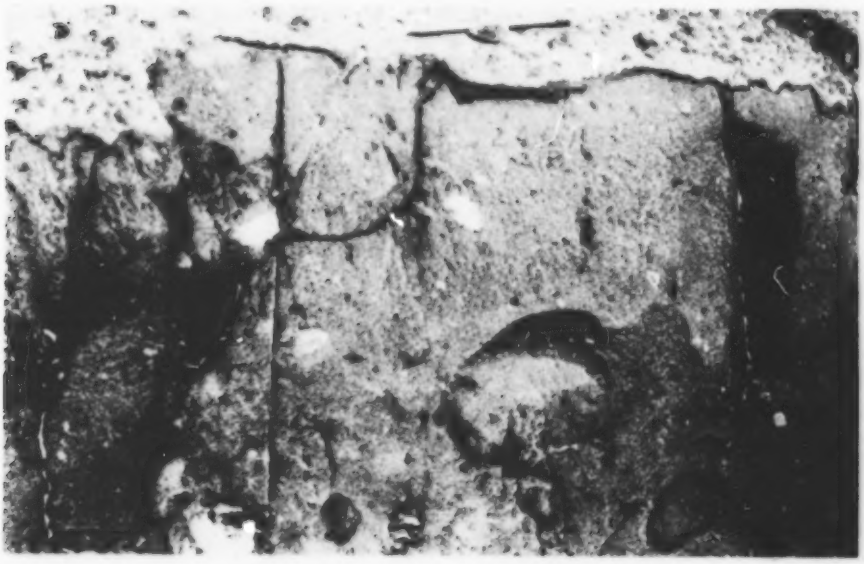

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Photo 5–Fresh surface of siliceous Mississagi paraconglomerate (7b) lot 3, concession V, Galbraith Township. Pale pebbles are quartz or granitic rock, dark angular clasts are mafic volcanic rocks. Note the nearly square vesicular mafic volcanic pebbles ¾ inch (18 mm) below and right of centre of print.

In the southwestern part of the map-area the Gowganda Formation has overlapped some Huronian formations; such an overlap also occurs in the southern parts of McMahon and Morin Townships to the west of the map-area (Chandler 1970a,b). The Quirke Lake Group is not present in the map-area, and has not been detected in diamond-drill holes (Figure 3 and Table 3).

Orthoconglomerate (Member 8A) and a closely packed paraconglomerate (Member 8B) are present at the base of a predominantly paraconglomerate (Member C) unit. The paraconglomerate is massive and consists of pebbles to boulders of mainly pink granitic rock set in a grey feldspathic wacke matrix. These three lithological types were grouped together in Member 8C. These conglomerates have been described in detail in many reports on Huronian geology (Casshyap 1967; Parviainen 1973; Robertson 1969; Roscoe 1969).

At two locations, boulders at the base of the Gowganda Formation appear to have been pressed into sandstone of the underlying Mississagi Formation; these are on the west shore of Skookum Lake and on the boundary of lots 1 and 2, concession VI, Galbraith Township, ¼ mile (0.4 km) south of Skookum Lake. In Haughton Township at the south boundary of lot 10, halfway between lots 9 and 11 in concession VI, flutings were seen at the contact between the Gowganda and Mississagi Formations which is at the base of a north-facing cliff. The flutings, with a wavelength of 9 inches (22.9 cm) and amplitude of 1½ inches

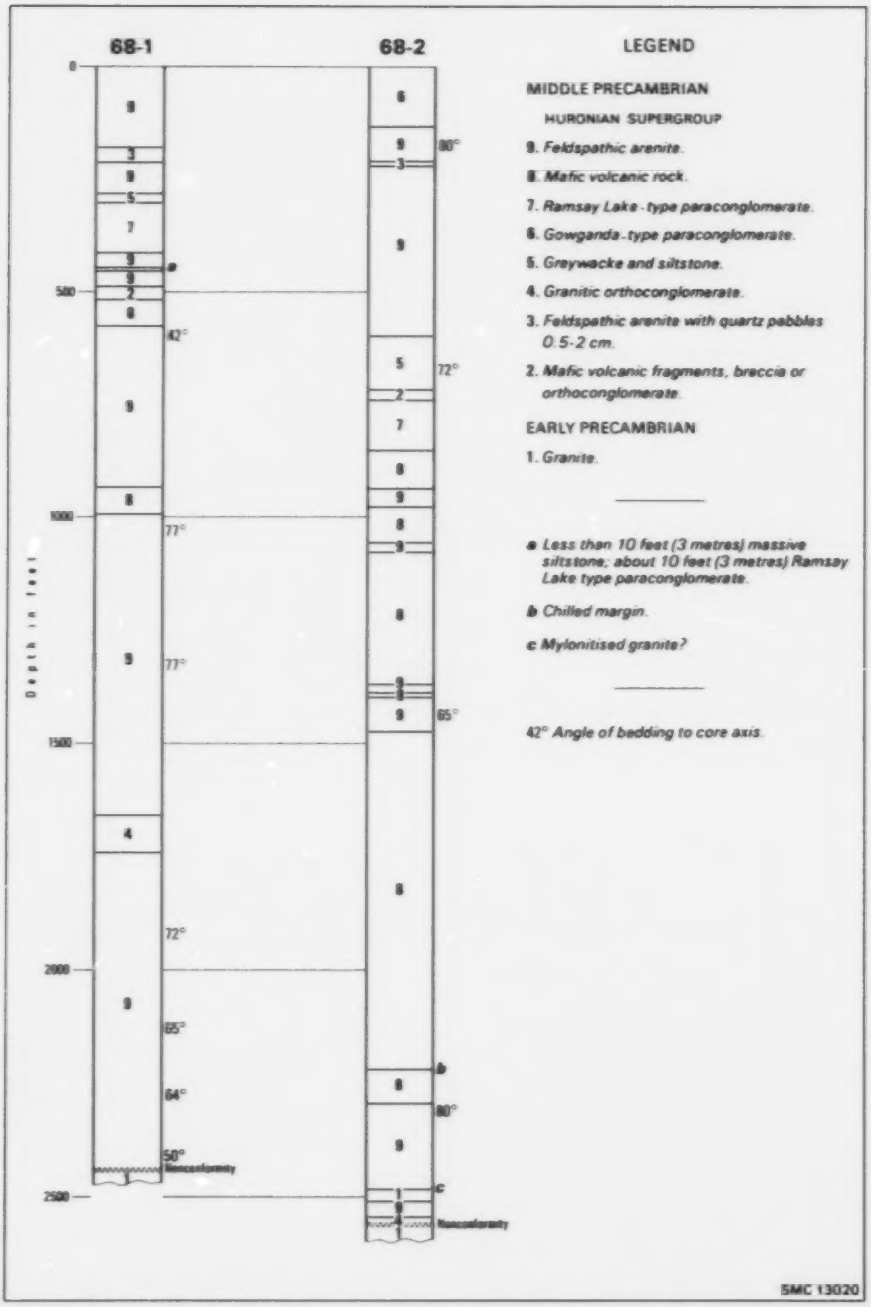


Figure 3–Diamond-drill hole logs for two diamond-drill holes near Skookum Lake (68-1) and Cooper Lake (68-2) drilled for Imperial Oil Enterprises Limited. Diamond-drill hole logs interpreted by F.W. Chandler (1971) from samples stored at Regional Geologist's Office, Ontario Ministry of Natural Resources, Sault Ste. Marie. For location of holes see Map 2331 in back pocket.

Table 3 | Diamond-drill holes in Saunders Lake area and adjoining area (see Figure 3).

| Diamond-drill hole No. on Figure 3 | Diamond-Drill Hole Number | Company Name | Year | Township | Espanola Formation recorded | Depth to Early Precambrian Rocks in feet and metres |
|---|---|---|---|---|---|---|
| 1 | 68-1 | Imperial Oil Enterprises Ltd. | 1968 | Galbraith | No | 2,443 (744.6m) |
| 2 | 68-2 | Imperial Oil Enterprises Ltd. | 1968 | Haughton | No | 2,550 (777m) |
| 3 | 68-8 | Imperial Oil Enterprises Ltd. | 1968 | Haughton | No | 1,868 (569.4m) |
| 4 | HA-1 | Kerr-McGee Corp. | 1968 | Haughton | No | 2,262 (689.5m) |
| 5 | 68-7 | Imperial Oil Enterprises Ltd. | 1968 | Haughton | No | 663 (202.1m) |
| 6 | 68-3 | Imperial Oil Enterprises Ltd. | 1968 | Gould | No | 531 (161.8m) |
| 7 | 68-6 | Imperial Oil Enterprises Ltd. | 1968 | Gould | No | 1,423 (433.7m) |
| 8 | No.1 | Rockwen Mines | 1955 | Gould | No | not reached at 700 (200m) |
| 9 | 68-1 | Pacific Petroleums Ltd. | 1968 | Grassett | No | 3,169 (965.9m) |

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Photo 6–Paraconglomerate (8c) near the base of the Gowganda Formation with disrupted sand beds, pale lenses and wisps of siltstone occur ¼ mile (0.4 km) on the Mississagi River downstream from the junction with Snowshoe Creek. Plane of photo is at 35 degrees to the bedding plane.

(3.6 cm) were traced 2 feet (0.6 m) along a bearing of S25°E. Laminations and crossbeds in the Mississagi Formation sandstone are truncated by the flutings. These features indicate mass movement of Gowganda paraconglomerate in a south-southeasterly direction before the consolidation of the Mississagi Formation.

In Galbraith Township, in the south half of lot 5, concession VI, and at the boundary between lots 2 of concession V and concession VI, respectively grey weathering, grey arkosic grit with granitic megaclasts is near the top of the conglomerate member (Member 8C). Above the conglomerate member, a sequence of interbedded laminated or massive argillite or argillite interbedded with rusty grey or buff weathering, blue-grey or green, medium- to fine-grained greywacke (Member 8EK) is exposed to the southwest beyond the limit of the map-area.

In the eastern half of the map-area several outliers of the Gowganda Formation are exposed in the vicinity of Burden and Green Lakes in eastern Otter Township, and ⅔ mile (1.1 km) southeast of Darragh Lake, and have overlapped older Huronian Formations to lie directly on the Early Precambrian granitic basement. Orthoconglomerate (Member 8A) and feldspathic sandstone (Member 8D) are locally present at the base of the unit, and the orthoconglomerate matrix is arkosic (Photos 6,7).

On the east bank of the Mississagi River 1½ miles (2.7 km) downstream from the mouth of Snowshoe Creek an outcrop visible at low water apparently

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Photo 7–Interbedded granitic pebble orthoconglomerate (right), coarse arkose (centre), and paraconglomerate (left) at base of Gowganda Formation. About 1 mile (1.6 km) upstream from the mouth of the Snowshoe Creek on the Mississagi River. Plane of outcrop dips about 20 degrees left (north), and bedding plane about 5 degrees north.

shows incorporation of granitic fragments in the basal Gowganda paraconglomerate Member 8C. The upstream end of the outcrop has a stockwork appearance consisting mainly of angular pebble- to cobble-size fragments of granite separated by vein-like seams of greywacke. Several feet (1-2 m) downstream, the megaclasts are more rounded and more sparsely dispersed in the greywacke. At the

southern end of the outcrop, at a distance of about 30 feet (9 m) from the upstream end of the outcrop, the fragments are even more rounded and dispersed in the greywacke. Here, the rock is essentially similar to other paraconglomerate units of the Gowganda Formation. Such a variable outcrop may have resulted from the action of quarrying, crushing, and dilution by ice with more distant material that may occur at the base of an eroding ice sheet (Flint 1971). Where Gowganda paraconglomerate overlies Early Precambrian granitic rocks, granitic boulders up to 6 feet (2 m) across may be present in the paraconglomerate. Toward the top of the member, close to the southwest shore of Jobammageeshig Lake in Gould Township, the matrix of the paraconglomerate is silty and in places purple, and contains lighter coloured wisps of purple silt. Some outcrops consist of grey to purple, fine-grained sandstone.

In lot 8, concession VI, Gould Township, Gowganda paraconglomerate is conformably overlain by finely laminated dark grey argillite (Member 8G). The transition occurs with a decrease in the size and abundance of megaclasts in the poorly sorted massive matrix of the paraconglomerate and with a subsequent development of lamination in the rock. The easily eroded argillite probably underlies Chub and Jobammageeshig Lakes, and is well exposed on the northwestern corner of a ¼-mile (0.4 km) long island in Jobammageeshig Lake in lot 8, concession VI, Gould Township.

The argillite is changed stratigraphically upward by the advent of rare fine sand and silt ripples which form lensoid bodies ¼ inch (5 mm) thick and several inches ( 13 cm) long. Higher in the sequence pink silt and fine-grained sand laminae and massive very thin sand beds increase in thickness until they are about 4 inches (10 cm) thick. At this thickness some beds appear to have slumped into the underlying argillite to form ball and pillow structures (Kuenen 1948). This slumped horizon is mappable at a scale of 1 inch to ¼ mile (1:15,840) and has been designated the Slumped Argillite Member 8J by the writer. Similar slumped argillite was found close to Snowshoe Creek ¼ to ½ mile (0.4 to 0.8 km) west of Highway 129, and may belong to a different stratigraphic level or may belong to Member 8J.

Examination of two thin sections from laminated argillite (Member 8EK) from the island in Jobammageeshig Lake showed lamination ranging from 0.15 to 4.0 mm in thickness. Quartz-rich silt laminae alternate with sericite-rich (flakes 0.05 mm long) clay laminae. Other laminae which are intermediate in composition are present between the quartz-rich and sericite-rich laminae. Some laminae are graded; others are massive. Quartz-rich laminae typically consist of over 50 percent angular quartz grains of variable sphericity (averaging 0.7), 25 percent chlorite, 7 percent orthoclase, 16 percent oligoclase (4 determinations); and the accessory minerals, white mica, black iron oxides, and calcite. Other than sericite, no other minerals could be identified in the clay-rich laminae.

### Lorrain Formation (?)

A sandstone member (Member 8D) that conformably and gradationally overlies Gowganda siltstone around Dam Lake and at the mouth of Snowshoe Creek may belong to the Lorrain Formation. Although the exact stratigraphic

position of Member 8D has not been determined, it has been included in the Gowganda Formation in this report. The boundary between the sandstone member (Member 8D) and the underlying slumped argillite member (Member 8J) was placed arbitrarily where sandstone and argillite are present in equal proportions. At this stratigraphic level, sandstone beds are over a foot (0.3 m) thick. The sandstone is pink weathering, grey to dark pink, and feldspathic in composition. The lower part of the unit is fine grained, and, at the highest stratigraphic level mapped by the writer is medium or rarely coarse grained. Bedding is obscure, and the rock may split at 3- to 6-foot (1 to 2 m) intervals. Crossbeds and ripples were seen in one exposure of the unit. Like grey feldspathic sandstone of the Matinenda Formation (5f) in southwest Otter Township, the 'Lorrain' sandstone contains disseminated pyrite which weathers on the outcrop surface to limonite.

One thin section of typical Gowganda sandstone from the north shore of Dam Lake (Specimen No. 22KC4) is a medium-grained arkose to subarkose consisting of quartz (75 percent), plagioclase (13 percent) orthoclase and microcline (10 percent), rare detrital white mica, and a matrix ($<$ 5 percent) of sericite and calcite. Opaque minerals include magnetite (much more abundant than pyrite) that has been partly altered to leucoxene and hematite. The quartz has sphericity values which range from 0.7 to 0.85, and is rounded to subrounded where original grain boundaries are not obscured by overgrowths.

## Stratigraphic Problems

The stratigraphic position of Huronian feldspathic sandstones that overlie Early Precambrian granitic rocks exposed in Morin, Otter, northeast Galbraith, and Haughton Townships is not definitely known. Lower Huronian feldspathic sandstones are isolated from other Huronian units by the Gowganda Formation which overlaps them from the south. Three Huronian formations, the Matinenda, Mississagi, and Serpent Formations (all deposited before the Gowganda Formation) are composed largely of feldspathic sandstone.

The correct correlation of these sandstones in the map-area may be significant economically, because to date the only economic deposits of uranium in the Elliot Lake area have been found in the Matinenda Formation.

The considered opinions of previous workers summarized by Chandler (1973) are as follows: Collins (1925) placed the sandstones in his 'Mississagi Quartzite', the latter term includes the McKim, Ramsay Lake, Pecors, Matinenda, and Mississagi Formations (see Figure 2) (see Robertson, Card, and Frarey 1969; also Robertson, Frarey, and Card 1969); Frarey (1959) placed the sandstones in the Serpent Formation; but Giblin and Leahy (1967) (see also Robertson, Giblin, and Leahy 1971) reverted to Collins' opinion. Various conglomerates in the area have been placed at different stratigraphic positions by the abovementioned authors.

A sequence of unfossiliferous sedimentary rocks is best correlated by tracing exposures from an adjacent type area, as Robertson did in the Elliot Lake area (Robertson 1960 *et seq.* ), [see Robertson, Card, and Frarey 1969, and Robertson, Frarey, and Card 1969] but Giblin and Leahy's (1967) map [see also Robertson, Giblin, and Leahy 1971] shows that the Gowganda Formation prevents this

approach from being used in the map-area because it obscures the other underlying Huronian rocks. A second technique used by geologists who mapped in the Espanola area (Casshyap 1967; Chandler 1969; Ginn 1965), where the Murray-Worthington Fault rendered the outcrop method used by Robertson (see Robertson 1968) inapplicable, was to compare the sequence with that from the type area. Particular attention was given to marker units such as the Espanola Formation, the only carbonate-rich unit in the sequence. This method is not easily applied in the present map-area because marker units such as the Espanola Formation (see Figure 2) are absent. A third technique involves tracing marker units from a type area in the 'subsurface' by using diamond-drill logs. A large number of diamond-drill hole cores have been logged from the Elliot Lake area and the area between the Elliot Lake area and the map-area. Nevertheless, insufficient subsurface data exist to correlate the rocks of the map-area with the Huronian sequence of the Bruce Mines area to the southwest. Furthermore, the Huronian succession beneath the Gowganda Formation is still poorly known in much of the area west of Elliot Lake.

Figure 4 is a simplified map of the northern margin of the Huronian supracrustal rocks present north of Thessalon and surrounding the map-area. Diamond-drill cores from the south and east part of Figure 4 (see Regional Geologist's Files, Ontario Ministry of Natural Resources, Sault Ste. Marie) record the existence of the Espanola Formation. Those from the central part of Figure 4 (see also Table 3) do not record the Espanola Formation. Because of the attitude and surface distribution of the Espanola Formation, it is probable that the Espanola Formation is probably largely absent in the area indicated on Figure 4.

The Bruce Formation has been recorded from north of the Espanola Formation outcrop (Figure 4) by some authors (see Frarey 1959; Giblin and Leahy 1967; Robertson, Giblin, and Leahy 1971). The writer examined these localities and concluded that those outcrops which do occur in the present map-area would be better placed in the Ramsay Lake Formation or a formation that is older than the Bruce Formation. One locality in Cummings Lake in Gould Township (Frarey 1961) would best be placed in the Gowganda Formation because of its appearance, and the fact that it is closely associated with the surrounding gently dipping rocks of the Gowganda Formation.

Erosion or non-deposition of the Quirke Lake Group over the Chiblow Anticline (possibly continuous with the 'Haughton High') involves progressive downward absence of units such as the Serpent Formation, then the upper parts of the Espanola Formation. Thus, information from diamond-drill core and outcrops show that the Bruce and Espanola Formations are not present in the map-area and southwest of it.

The rocks in the Matinenda, Mississagi and Serpent Formations are mainly feldspathic arenites. Potassic feldspar is more abundant than plagioclase in the Matinenda and Mississagi Formations, but plagioclase is the dominant feldspar in the Serpent Formation. The petrographic data in Geological Report 112 (see Chandler 1973) and in this report show that plagioclase is also the dominant feldspar in the Gowganda feldspathic sandstone (Figure 5).

A regional study of the Huronian rocks along the North Shore of Lake Huron involved the distribution of units, paleocurrents, and structure, and implied a miogeosynclinal continent-margin sequence with the 'ocean' to the southeast

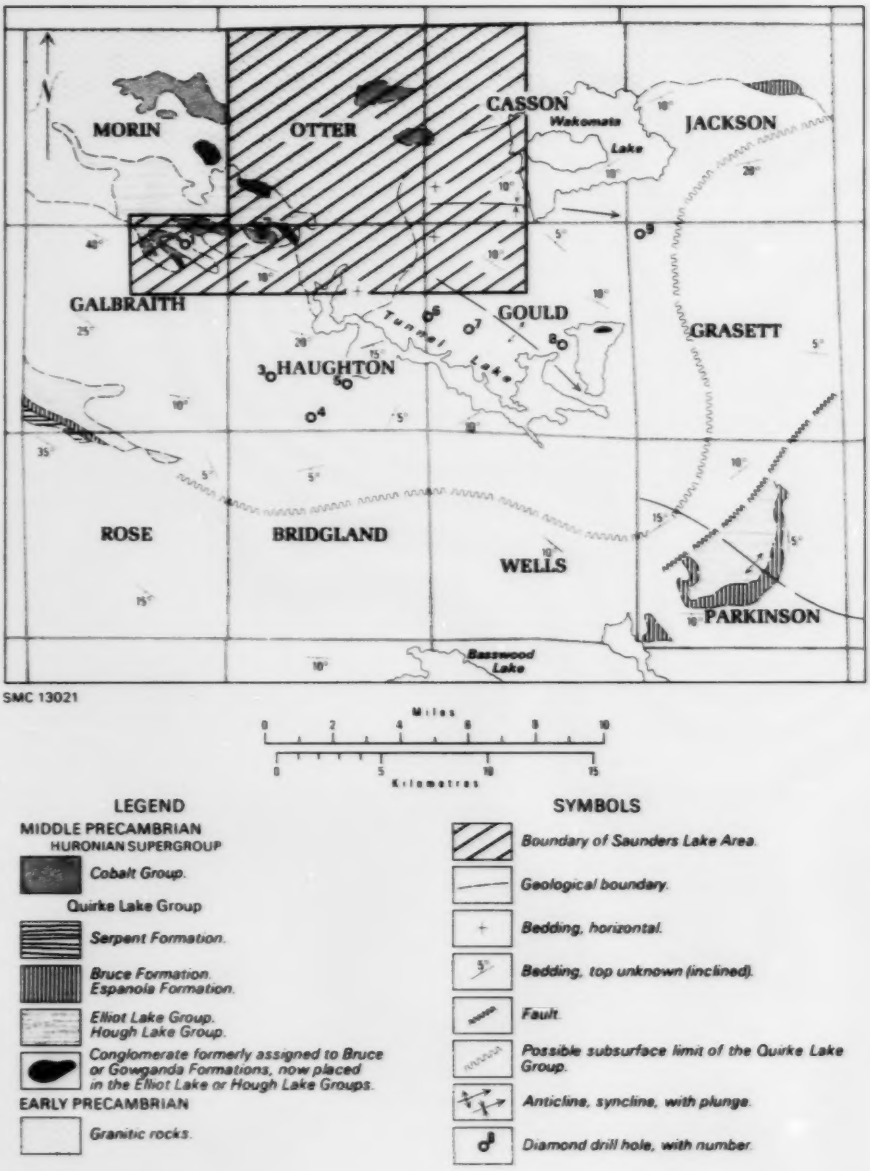


**Figure 4–Simplified geological map of Saunders Lake area and adjacent terrain to show possible limit of Quirke Lake Group.**

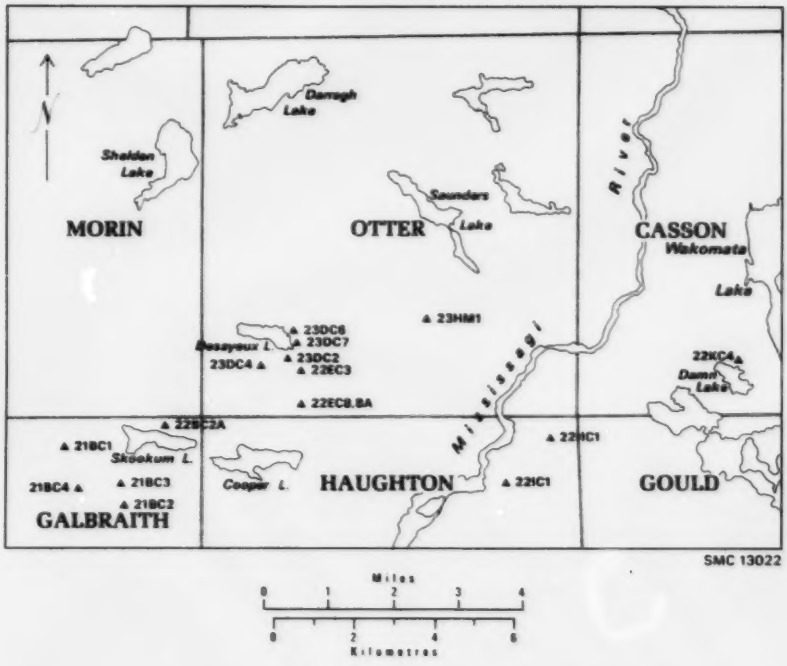


Figure 5–Map to show location of thin sections discussed in report.

(Dickinson 1971), (Dietz and Holden 1966). Thus, it is not surprising that in the area argillaceous formations thin to the north and west where an arenaceous sequence with local unconformities would be expected. For example, Robertson's (1968) work in the Elliot Lake area with the Ontario Department of Mines has shown that the argillaceous McKim Formation is present on the south, but is not present on the north limb of the Quirke Syncline. Roscoe (1969) reported the absence of the McKim Formation northwest of the northeastern corner of Timmermans Township (formerly Township 161) which is about 12 miles (20 km) southeast of the map-area. The argillaceous and sandy Pecors Formation thins northwestward from a maximum thickness of over 2,600 feet (800 m) in Harrow Township near Espanola (Chandler 1969) across the Quirke Lake Syncline to about 100 feet (30 m) at the northwestern corner of Quirke Lake (Robertson 1967). The Pecors Formation decreases in thickness from 700 feet (200 m) near Thessalon, to being very thin, or perhaps absent 14 miles (22.5 km) north of Bruce Mines at Aberdeen Lake; its possible equivalent at the northeastern end of Trout Lake 30 miles (48 km) northwest of Bruce Mines is also very thin (Roscoe 1969).

The Huronian sequence expected by the writer in the map-area is arenaceous, but some formations, particularly the more argillaceous are predicted to be thin or absent. A further complication is the thinning and absence (in the area) of the Quirke Lake Group over the Chiblow-Haughton Structure (the Chiblow Anticline and its extension into Haughton Township).

Evidence from Quirke Lake and the Gowganda-Cobalt area shows that paraconglomerates of the Ramsay Lake and Gowganda Formations overlap older Huronian Formations and lie on Early Precambrian basement. Such an overlap would be expected in a subsiding miogeosynclinal model of sedimentation, in which mudflows would transgress environments which vary from terrestrial to marine. Transgression of paraconglomerate across other rock types is also to be expected using a glacial model of paraconglomerate depositions. Such transgressions are shown by Ramsay Lake and Gowganda paraconglomerates in the map-area.

The writer has tentatively assigned sequences to the Gowganda Formation that are within the Huronian sequence, and that form outliers on the Early Precambrian surface. In Morin Township the identification of paraconglomerate units was not complex (Teal 1971), because outliers were similar in appearance either to the Gowganda Formation or to a siliceous paraconglomerate unit which was in turn assigned to the Ramsay Lake Formation. However, in the map-area, apart from the siliceous paraconglomerate outliers similar to those in Morin Township, there are several siliceous paraconglomerate beds enclosed within the feldspathic sandstone sequence.

F.Q. Barnes, [D.S. Robertson and Associates Limited] (personal communication 1971) reported that similar paraconglomerate units are enveloped by feldspathic sandstones, and are exposed close to the Early Precambrian basement in the Agnew Lake area north of Espanola (Card 1964). Diamond drill-core data (see Figure 3) and surface data suggest that the paraconglomerate which is exposed on the south shores of Skookum and Cooper Lakes is a fault repetition of the one close to St. Onge Lake in Otter Township. This conglomerate may belong to the Ramsay Lake Formation. The writer has correlated the St. Onge Lake paraconglomerate with a paraconglomerate in Morin Township, the Ramsay Lake Formation.

If the paraconglomerate (6) is placed in the Ramsay Lake Formation, other paraconglomerate beds in northeast Galbraith Township which appear to be higher in the stratigraphic succession may be placed in the Mississagi Formation. Nevertheless, the paraconglomerate beds are similar in appearance to those placed in the Ramsay Lake Formation. Also associated with them are thin siltstones similar to those that the writer suggests might be representative of the Pecors Formation on the south shore of Cooper Lake.

The confused situation would be resolved by having a better understanding of the stratigraphy of Galbraith Township. This might be gained by more detailed mapping and diamond drilling between the northeastern part of Galbraith Township, which is already mapped, and the exposures of the Quirke Lake Group in the southwestern corner of Galbraith Township.

## MIDDLE TO LATE PRECAMBRIAN

### Mafic Intrusive Rocks

The regional development of these rocks has been reviewed briefly by the writer (see Chandler 1973). The following rocks are placed in the Mafic Intrusive Rocks: Nipissing Diabase, also called quartz diabase (9a, b), similar diabase of uncertain age found cutting only Early Precambrian rocks (9c), and olivine diabase (9d) also called the 'Sudbury Dikes'.

Nipissing Diabase is of interest because silver mineralization is associated with it in the Cobalt area, and copper mineralization is associated with it along the North Shore of Lake Huron. The rock forms sills and dikes in the map-area. The typical rock is greenish white to black, weathers mottled green-white, buff and black, and has a grain size of 2 to 4 mm. A prominent sill has been traced from McMahon Township about 9 miles (15 km) west of the area (Chandler 1970a, 1973) to the northwestern corner of Wakomata Lake in Casson Township (formerly Township 188). The sill contains quartz diabase (9a) and is described in more detail in Chandler (1973). The sill also contains granophyre, a leucocratic dark pink rock called by local inhabitants 'red rock' (9b). Granophyric diabase intermediate in field appearance between (9a) and (9b), was grouped on the map legend under the heading 9b (see Map 2331, back pocket). The petrography of typical samples of granophyre and granophyric diabase is summarized below. Smaller quartz diabase dikes having no apparent differentiation, trend mainly northwest and northeast in the area, and cut Early Precambrian and Huronian rocks. Some of these dikes can be traced several miles (5 - 7 km) as prominent cliff-forming ridges. Contact metamorphic effects from the Nipissing Diabase are negligible, but copper mineralization (see section on 'Economic Geology') in quartz-carbonate veins bears a strong spatial relationship to the diabase.

A thin section of granophyric diabase consists of about 80 percent saussuritized labradorite, 10 percent augite, 10 percent interstitial quartz, and trace amounts of chlorite, biotite, ilmenite, and leucoxene. A thin section of granophyre contains 35 percent quartz, 35 percent albite, 25 percent hornblende, 5 percent opaque iron oxides and minor epidote. Hematite in the feldspar stained the thin section pink and presumably caused the red appearance of the rock in the field.

Olivine diabase (9d) is fresh, black, weathers rusty, and forms rare dikes in the map-area. It was not possible to trace the olivine diabase for more than half a mile (0.8 km).The olivine diabase cuts only Early Precambrian rocks in the area, but is similar to the olivine diabase (Sudbury Diabase) of other areas. It is probable that the olivine diabase dikes in the area postdate the quartz diabase of uncertain age.

## Phanerozoic

### CENOZOIC

### Quaternary

#### Pleistocene and Recent

A summary of the regional Quaternary Geology of the area may be obtained from Chandler (1973). A recent description of this is also given by Boissonneau (1968).

Discontinuous boulder fields or thin deposits of sandy till or gravelly till cover much of the map-area. Glacial striations show that the most recent ice flowed south and southwest. The Mississagi River valley and 2 square miles ( 5 $km^2$) on the western shore of Wakomata Lake are underlain by thick terraces of fluvial gravel. Sand and silt underlie most of lots 8 and 9, concession V and VI, Haughton Township.

## STRUCTURAL GEOLOGY

In the Early Precambrian rocks, weakly developed foliation, many dike-like bodies of mafic intrusive rock, and some major lineaments strike northwest. In northeastern Haughton Township the Early Precambrian rocks are part of a structural salient known as the 'Haughton High' which penetrates southward into the area of Huronian outcrop. Arguments given previously in the section 'Stratigraphic Problems' indicate that this feature, visible on Giblin and Leahy's (1967) map (see Robertson, Giblin, and Leahy 1971), may be the northwestward continuation of the Chiblow Anticline. The Chiblow Anticline is a structural elevation which was positive during Huronian time (Young and Church 1966). This activity may account for the absence (noted also in diamond-drill core, Figure 3, this report) of pre-Gowganda Huronian rocks, particularly the Quirke Lake Group, to the southeast of the 'Haughton High'.

In the southwestern part of the area, Huronian rocks dip 10 to 20 degrees south to southwest. Schistosity is only locally developed; it may be related to faulting as in the metavolcanics and the Ramsay Lake Formation along the line of Skookum and Cooper Lakes.

Faulting is suggested by the truncation of a prominent ridge of Gowganda paraconglomerate at an east-striking negative lineament in lot 3, concession VI, Galbraith Township. Faulting is indicated along the trend of Cooper and Skookum Lakes by the following evidence:

(a) The southward-dipping basal surface of the Gowganda Formation, found at lake level on the northern shore of Skookum and Cooper Lakes is about 200 feet (60 m) higher in the hillside on the southern side of these lakes.

(b) Two exposed prominent paraconglomerate units, about 100 feet (30 m) thick are probably caused by fault repetition. The first unit passes through Skookum and Cooper Lakes, and the second unit passes through St. Onge Lake into Morin Township; both should have been cut by borehole number 68-1 (shown on Figure 3). Only one of the two paraconglomerates is cut by borehole number 68-1 (see Figure 3), and it is probable that the outcrop formed by the southern of the two conglomerates is the result of repetition of the northern conglomerate by high-angle reverse faulting with upthrow to the south.
(c) The valley of Skookum and Cooper Lakes is a well-developed lineament.
(d) Huronian volcanic rocks in the Skookum-Cooper Lakes valley are juxtaposed with the Gowganda Formation, and volcanic rocks are not known to have been erupted during 'Gowganda time' elsewhere on the North Shore of Lake Huron.
(e) Diabase dikes appear to have been truncated along the Cooper-Skookum Lakes lineament.

The Cooper-Skookum Lakes lineament is on strike with another lineament in the eastern part of the map-area. Chalcopyrite is associated with the latter lineament in lot 11, concession V, Gould Township.

Minor crenulation of laminations and small-scale open folds, with axes plunging slightly east of southeast are present in laminated Gowganda argillite on the shores of Jobammageeshig Lake.

## ECONOMIC GEOLOGY

Sulphide mineralization in the map-area consists of: firstly, copper sulphide minerals in quartz veins in various rock types; and secondly, disseminated pyrite in quartz pebble orthoconglomerate (5b), in pyritic grey micaceous sandstone (5f) of the Matinenda Formation, and in feldspathic sandstone of the Gowganda or Lorrain Formation (8d).

Copper sulphide minerals occur mainly as chalcopyrite, rarely as chalcocite, in east- to southeast-trending steeply dipping quartz veins in fractures and shear zones. At the east end of Burden Lake, gold, silver, bismuth, cobalt, and nickel mineralization have been found. Gangue minerals include carbonate specularite, and pyrite. The veins occur both in Early Precambrian and Huronian rocks and in close proximity to diabase intrusions. The veins are rarely more than several inches (7 cm) wide. Exceptions were noted at properties 4 and 7 (see Map 2331, back pocket). A quartz diabase sill of Nipissing-type with granophyric parts is as much as 1 mile ( 1.6 km) across, strikes east across the centre of the map-area, and seems a probable site for vein-type copper mineralization.

Pyritic quartz-pebble orthoconglomerate and quartz pebbly arkose, similar to the uranium-bearing facies of the Matinenda Formation of Elliot Lake occur on the central part of the south boundary of Otter Township (property 5 on Map 2331, back pocket).

## Descriptions of Mineral Occurrences and Properties

### GOLD, SILVER AND COBALT

#### A. Helfrick (3)[1]

Six patented claims owned by Mr. A. Helfrick of Elysburg, Pennsylvania, U.S.A. partly straddle a 3,300-foot (1000 m) long quartz-carbonate vein system that strikes S25°E. Two of the claims are in Otter Township, namely SSM2340 in the northeast quarter of the south half of lot 2, concession IV, and SSM2339 in the northeast quarter of the south half of lot 1, concession IV. The other four are on, and adjacent to the western edge of Casson Township (formerly Township 188), and are numbered SSM2163, SSM2307, SSM1728, and SSM2338.

The quartz-carbonate vein system may be reached by landing a float-equipped aeroplane on Burden Lake or portaging a canoe from Saunders Lake to Burden Lake; thick undergrowth makes the latter approach arduous. The best access is made with a four-wheel-drive vehicle that would go west from Highway 129 to the Mississagi River. The river can be crossed by canoe and the quartz-carbonate veins reached on foot. A sand road runs from Highway 129 to the river 0.8 mile (1.2 km) east of the vein system. The vein system is associated with a diabase sill and is similar to the vein-type copper occurrences of the area. The veins also cut across Early Precambrian granitic rocks in Casson Township (Formerly Township 188).

Observations made in the 1971 field season are as follows: at the southeastern corner of Burden Lake a 3-foot (0.9 m) wide vertical unmineralized quartz-carbonate vein in Nipissing Diabase strikes S50°E. About 400 feet (120 m) north of this vein, a 12-foot (3.7 m) wide quartz-carbonate vein with a similar strike and dip was also found in Nipissing Diabase. Minor chalcopyrite and specularite were found over a distance of 2 feet (0.6 m) along the edge of the vein. The other margin of the vein consists of quartz and carbonate with little specularite. The middle 6 feet (1.8 m) of the vein is stained with earthy hematite and specularite.

### COPPER

#### Fano Occurrence (1)

Shklanka (1969, p.47) reported that quartz-carbonate-chalcopyrite-pyrite veins occur in a shear zone which cuts granite and 'greenstone' (see Regional Geologist's Files, Ontario Ministry of Natural Resources, Sault Ste. Marie). The zone strikes east and is probably vertical. The zone was traced for a length of

[1] Number in parentheses refers to property number on Map 2331 in back pocket.

3,300 feet (1,000 m) by diamond drilling; the two best assays recorded were 1.71 percent copper over 2.0 feet (0.6 m) in diamond-drill hole No. 4, and 3.51 percent copper over 5 feet (1.5 m) from diamond-drill hole No. 1 (see files in Assessment Files Research Office, Ontario Division of Mines, Toronto). The diamond drilling, consisting of a total length of 1,002.5 feet (305.7 m) in six holes, was done in 1956 by Inspiration Diamond Drill Company for Fano Mining and Exploration Incorporated (see files in Assessment Files Research Office, Ontario Division of Mines, Toronto).

Maps in a report that describe the above diamond drilling are in the Assessment Files Research Office, Ontario Division of Mines, Toronto, and place the occurrence about 1,700 feet (520 m) north of the western end of Desayeux Lake in Otter Township. This would place the occurrence in rocks mapped by the writer as Early Precambrian granitic rocks. The writer's field party was not able to locate any of the above listed diamond-drill holes.

Burrows (1910,p.196) reported mineralization of the vein system as follows:

> On the Kerr claim, S.E.¼ of S. ½ lot 1, con.4, there are two quartz veins which strike N. 65°W. The northerly vein which at one point has a width of 12 feet [3.7 m], contains copper pyrites and specular iron ore, in addition to the quartz and calcite. The southerly vein has been stripped over a distance of 230 feet [70m], and at one place a pit has been sunk 13 feet [ 4.0 m]. In the pit the vein is 7 feet [2.1 m] wide, consisting for the most part of quartz, or quartz and diabase in a reticulated structure. Calcite occurs in lesser amount and cobaltite and native bismuth have been found in small masses. To the east and west of the pit the vein is much narrower.
>
> On the adjoining claim to the east there is a quartz vein with a similar strike averaging a foot [0.3 m] in width. It has a decided comb structure, some of the quartz crystals being an inch in diameter. Calcite and occasionally cobaltite and native bismuth have been deposited between the quartz layers, and thin sheets of bismuth sometimes occur on the smooth faces of the quartz crystals.
>
> One sample from the Kerr claim, consisting mostly of bismuth, gave on assay: gold, .03 oz; silver 15.9 oz; bismuth, 59.5 percent; cobalt, trace. A sample of massive cobaltite gave on assay no gold or silver.

Sergiades (1968, p.20) listed a bulk assay of 3.7 tons which yielded 14.7 percent Co, 9.2 percent Ni, 9 ounces of gold per ton and contained native silver.

## Gould Copper Mine Limited (2)

Gould Copper Mine Limited of Elliot Lake probably hold a group of leased claims in lots 8, 9, 10, and 11, concessions V and VI, Gould Township.

The Gould Mine is located in the south half of lots 10 and 11, concession VI, Gould Township, about 2,200 yards (2,000 m) from Highway 129, and can be reached using a gravel road which runs west from its junction with Highway 129, which is approximately ½ mile (0.8 km) north of the creek draining Huston Lake into Jobammageeshig Lake.

The best exposure of the diamond-drilled vein, which is mineralized in nearly horizontal Gowganda paraconglomerate, is associated with Gowganda feldspathic sandstone and laminated argillite.

Numerous quartz veins in the area carry chalcopyrite. Pits have been sunk 1¼ miles (2 km) southwest of the drift (shown on Map 2331, back pocket) and in

a quartz vein about a mile (1.6 km) west on Urquhart Lake. In lot 11 and the north half of lot 12, concession VI, Gould Township, and in the north half of lot 1, concession VI, Haughton Township, many other small chalcopyrite-bearing quartz veins have been uncovered. Observations on some of the trenched and pitted veins were recorded in 1971 by R.J. Rupert, formerly the Resident Geologist at Sault Ste. Marie (see Regional Geologist's Files, Ontario Ministry of Natural Resources, Sault Ste. Marie).

The Gould Mine adit lies in an east-facing cliff about 25 feet (7.6 m) high consisting of Gowganda paraconglomerate and sandstone. Mineralization occurs in a shear zone that strikes N66°W, dips south at 60°S, and is probably a reverse fault. The shear zone is quartz veined, hematite stained, and is 40 feet (12 m) wide. The 10-foot (3 m) square opening of the adit mouth lies on a 6-foot (1.8 m) wide zone of the best mineralization, the southern part and northern 3 feet (0.9 m) of which contain abundant specularite.

According to Shklanka, (1969) in 1967 a test pit exposed the vein for a length of 10 feet (3 m) and a width of 3½ feet (1 m) including a 1 foot (0.3 m) of massive chalcopyrite and specularite. In 1966-1967, trenching and 80 feet (24 m) of diamond drilling in one hole was done by G. Poirier. In 1968, trenching was carried out by Gould Coppermine Limited. A general account of the work is given in the Elliot Lake Standard (1969).

R.J. Rupert selected grab samples from the ore dump near the drift for assay in 1971; the results of the assays are not known (Regional Geologist's Files, Sault Ste. Marie, Ontario Ministry of Natural Resources).

## Reuben McKee (7)

The mineralized quartz vein is located at the centre of lot 1, concession III, Otter Township, and may be reached by crossing the Mississagi River with an amphibious four-wheel-drive vehicle.

This mineralized quartz vein lies in an area where Early Precambrian granitic rocks are cut by Nipissing Diabase. To the south, an outlier of Gowganda paraconglomerate partly surrounds the mineralized quartz vein at a distance of about 300 feet (90 m). An east-striking Nipissing-type diabase dike lies about 300 feet (90 m) to the north of the deposit.

In 1968, R.A. Benkis and H. Beckman,(see files in Assessment Files Research Office, Ontario Division of Mines, Toronto) noted chalcopyrite mineralization in a 5- to 7-foot (1.5 to 2 m) wide quartz vein in a basic dike intruded into Early Precambrian granite. A magnetic and electromagnetic survey described by Benkis and Beckman indicated a 500- to 600-foot (150 to 180 m) long vein (Assessment Files Research Office, Ontario Division of Mines, Toronto).

Four diamond-drill holes that were drilled in 1971 and a pit were located on the property by the writer in the summer of 1971 relative to a survey picket 1 + 00 south 6 + 00 west as follows [ according to the author]:
Diamond-drill hole number 1, bearing S22°E, distance 260 feet (80 m).
Diamond-drill hole number 2, bearing S12°E, distance 180 feet (55 m).
Diamond-drill hole number 3, bearing S22°W, distance 135 feet (41.1 m). The drill hole dips 60° toward S34°.

Diamond-drill number 4, due west, distance 190 feet (58 m). The diamond-drill hole dips 70° due south.

The pit [not shown on Map 2331, back pocket] was located 230 feet (70 m) on a bearing of S12°W

In 1971, the writer examined the diamond-drill core from the four holes that was left at the diamond-drill hole sites. Diamond-drill holes one to three were about 350 feet (110 m) long, and drill hole number four about 165 feet (50 m) long. They penetrated diabase and granite. Mineralization in the core is as follows:

None was observed in diamond-drill core left at hole one.

Hole number two contains a 3-foot (0.9 m), (apparent) thickness of a quartz-carbonate vein at a length of 20½ feet (6.2 m) in the hole with a 1 inch (2.5 cm) width of 50 percent chalcopyrite

Hole three contains 50 percent chalcopyrite in diabase at a length between 129 and 131 feet (39.3 and 39.9 m) and 30 percent chalcopyrite in a quartz-carbonate vein between the lengths of 134 and 136 feet (40.8 and 41.6 m).

In hole four, a barren quartz-carbonate vein was found between the lengths of 135 and 137 feet (41.1 and 41.7 m) and at a length of 162 feet (49.4 m) there occurred ½ inch (13 mm) of chalcopyrite.

The pit covers 1 square yard (0.8 $m^2$), and in it is exposed a 2½-foot (0.76 m) wide vein striking northeast (63°) and dipping N75°W. The vein contains two zones 1 inch (25 mm) and ½ inch (13 mm) wide respectively consisting of chalcopyrite. Many angular blocks 6 inches (15 cm) to 1 foot (0.3 m) in maximum dimension, and which contain 50 to 75 percent chalcopyrite with minor quartz, were scattered around the pit.

In 1967, the vein was exposed by R. McKee (Regional Geologist's Files, Ministry of Natural Resources, Sault Ste. Marie). From the condition of the diamond-drill core the author considers that the four diamond-drill holes described above were drilled in 1971.

## Resource Exploration and Development Company Limited (6)

Resource Exploration and Development Company of Toronto hold several claims in northwestern Gould Township that include the Cheney Mine.

The Cheney Mine is located in lot 7, concession V, Gould Township ½ mile (0.8 km) south of Chub Lake. The head frame is located within 300 feet (90 m) of Highway 129 on the west side of the road.

The mine lies within a Gowganda paraconglomerate member, which includes subordinate sandstone and orthoconglomerate dipping 10°S and N. A quartz vein about 100 feet (30 m) east of the mine strikes east and dips 50°S. A quartz vein 700 feet (210 m) southwest of the mine strikes N80°W and dips 65°S. The mineralized vein in the mine is reported by Shklanka (1969) to strike east and dip 45° to 60°S. It is cut by later diabase dikes. Chalcopyrite, pyrite, specularite, siderite or ankerite, barite, and calcite occur in the veins.

The following account is condensed from Shklanka 1969, p.26-27:

The zone has been traced by diamond drilling to a depth of 460 feet (140 m) and on the surface it has been traced 4,000 feet (1,200 m) along strike. The width

varies from a few inches (7 cm) to 17 feet (5.2 m), averaging about 5 feet (1.5 m). Reserves are estimated at 39,405 tons grade 3.97 percent copper, and are in shoots. The main shoot, near the shaft, contains 30,570 tons grade 3.9 percent copper for a length of 192 feet (58.5 m) and an average width of 5.8 feet (1.8 m), and a smaller lens, west of the main shoot, contains over a length of 60 feet (18 m) and an average width of 4.5 feet (1.4 m). Approximately 3,500 tons were mined in 1967.

In 1916 numerous trenches and a few small pits were dug and an inclined shaft was sunk 70 feet (20 m), and a few feet of drifting was done at the 50-foot (15 m) level. Seven carloads of ore were shipped from which 33,468 lbs of copper valued at $8,564 were recovered. The work was carried out by Timmins interests [developers living in Timmins] under option from Cheney Copper Mines Limited. In 1928 to 1929, the shaft was sunk to 150 feet (46 m) and 1,625 feet (495.3 m) of drifting and 860 feet (260 m) of cross-cutting was done on the 150-foot (46 m) level. Sudbury Basin Mines Limited carried out 2,514 feet (766.3 m) of surface diamond drilling. In 1955 to 1956, 4,723 feet (1,439.6 m) of surface diamond drilling was done in eight holes by Tholesby Sudbury Basin Mines Limited. In 1960 Rothsay Mines Limited carried out magnetic and electromagnetic surveys. In 1966 to 1967 the Cheney Mine was rehabilitated and about 3,500 tons of material were shipped to the mill at Copper Concentrators Limited in Kamichisitit Township (formerly Township 168).

## URANIUM

### Imperial Oil Uranium Enterprises Limited [1968] (4)

Several diamond-drill holes were drilled by Imperial Oil Enterprises Limited around the southern margin of the 'Haughton High' to test for uranium. Two diamond-drill holes were drilled to the Early Precambrian basement in the map-area. Their locations are on the northern shore of Cooper Lake and near the southwestern corner of Skookum Lake. Gravel roads lead to within ½ mile (0.8 km) and ¼ mile (0.4 km) of the sites respectively. Though the diamond-drill core has been thrown away, samples that were taken every few feet (1-2 m) are kept in the office of the Regional Geologist at Sault Ste. Marie. Also, the diamond-drill core-logs are on file at the Assessment Files Research Office, Ontario Division of Mines, Toronto.

These diamond-drill holes are significant in the interpretation of the structure and stratigraphy of the map-area. Figure 3 is an interpretation, by the author, of the diamond-drill core in storage at the Regional Geologist's Office, Sault Ste. Marie. Further, 1,100 apparent feet (340 m) of mafic volcanic rocks were penetrated by the diamond-drill hole at Cooper Lake. No uranium mineralization was recorded from either one of the diamond-drill holes, 68-1 and 68-2 (Assessment Files Research Office, Ontario Division of Mines, Toronto).

### Kerr Addison Mines Limited [1966] (5)

Four diamond-drill holes were drilled less than 300 feet (90 m) apart on a hillside on the east side of the gravel road on the north boundary of lot 9, concession VI, Haughton Township. The sites of the collars for the diamond-drill holes, two of which are shown on Map 2331 (back pocket) are all less than 400 feet (120 m) from the gravel road, and were drilled in 1966 by Kerr Addison Mines Limited. The diamond-drill holes were drilled in Matinenda feldspathic sandstone with or without pebbles and in quartz pebble orthoconglomerate. About 300 feet (90 m) southwest of the diamond-drill holes metabasalt is exposed on the eastern side of the gravel road. Feldspathic sandstone and quartz-pebble orthoconglomerate compose the upper part of the drill core in all four diamond-drill holes as follows: Number 66-1, 0 to 22 feet (0 to 6.7 m); Number 66-2, 0 to 61 feet (0 to 18.6 m); Number 66-3, 0 to 105.7 feet (0 to 32.2 m); and Number 66-4, 0 to 94.6 feet (0 to 28.8 m). The lower part of the diamond-drill cores is composed of greywacke, subgreywacke, and granitic boulder conglomerate as follows: Hole Number 66-1, 22 to 32.3 feet (6.7 to 9.8 m); Hole Number 66-2, 61 to 144 feet (18.6 to 43.9 m); Hole Number 66-3, 105.7 to 141.2 feet (32.2 to 43.0 m); and Hole Number 66-4, 94.6 to 142 feet (28.8 to 43.3 m). This stratigraphy is similar to that at the base of the Matinenda Formation at Desayeux Lake (see section on 'General Geology'). The diamond-drill core-logs are stored in the Regional Geologist's Office, Ontario Ministry of Natural Resources, Sault Ste. Marie.

No uranium mineralization was recorded in the diamond-drill logs by Kerr Addison Mines Limited (see Regional Geologist's Files, Ontario Ministry of Natural Resources, Sault Ste. Marie).

### Snowshoe Creek Occurrence (?)

The precise location of the Snowshoe Creek Occurrence is not known (Assessment Files Research Office, Ontario Ministry of Natural Resources, Toronto) even though Shklanka stated that it is located ¼ mile (0.4 km) west of Wakomata Lake (Shklanka 1969, p.99). Nevertheless, a map showing locations of diamond-drill work in Casson Township (formerly Township 188) shows that Pluton Uranium Mines Limited did their diamond drilling west of Wakomata Lake (how far west is not known) and north of Snowshoe Creek (Assessment Files Research Office, Ontario Division of Mines, Toronto). The reader's attention should be directed to chalcopyrite found by the author at the following localities: 1) in quartz carbonate veins in a pit 500 feet (150 m) west of Wakomata Lake and south of Snowshoe Creek; 2) in a shear zone 400 feet (120 m) east of Highway 129 in patented claim 11435. This claim is probably held by H.C. Kells of Lewiston, Idaho, U.S.A. No other information is available to date on this claim.

The Snowshoe Creek Prospect was not found by the writer. Maps in the Regional Geologist's Files, Ontario Ministry of Natural Resources, Sault Ste. Marie, show that the prospect is close to a gravel road running southeast from Highway 129 to the north of Snowshoe Creek.

Shklanka (1969, p.99) reported that the mineralization was located in a

shear zone with an exposed width of 18 feet (5.5 m) located in argillite. Malachite was recorded in the sheared argillite. This lithological environment is consistent with the occurrence of Gowganda Formation argillite on strike ½ mile (0.8 km) southwest. The sandstone to the north of the occurrence (see Map 2331, back pocket) probably overlies the argillite because diamond-drill logs from Pluton Uranium Mines Limited record passage from quartzite into laminated argillite (Regional Geologist's Files, Ontario Ministry of Natural Resources, Sault Ste. Marie).

A sample of diamond-drill core taken in 1956 assayed 2.02 percent copper over 9 feet (2.7 m) (Shklanka 1969, p.99). No mineralization was recorded from subsequent diamond-drilling of 2 holes to test the down-dip extension of the shear zone.

In 1956, Pluton Uranium Mines diamond drilled three holes totalling 546 feet (166.4 m) after an encouraging geophysical survey. Mineralization was noted in diamond-drill holes 1, 2, and 3; the ore minerals are chalcopyrite and chalcocite (see Files in Assessment Files Research Office, Ontario Division of Mines, Toronto).

In 1966, Jubilant Creek Mines Limited did a magnetic and an electromagnetic survey and also diamond drilled 1,766 feet (538.3 m) in five holes; no copper mineralization of note was found, although one sample of diamond-drill core assayed 2.02 percent copper, nil gold, and nil silver over 9 feet (2.7 m), (see Assessment Files Research Office, Ontario Ministry of Natural Resources, Toronto).

## Miscellaneous Development Work

Several minor copper occurrences have had development work done on them. These are listed under the appropriate township, in the Regional Geologist's Files, Ontario of Natural Resources, Sault Ste. Marie.

## Aerial Geophysical Surveys

Geophysical surveys of parts of the area have been flown in 1968 by Subeo Limited and by W.D. Sutherland and Associates. A linear magnetic anomaly striking east ¼ mile (0.4 km) north of Desayeux Lake may correspond to the shear zone of occurrence three on Map 2331, (back pocket).

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